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THE ECONOMIC BEARING OF HOVER-FLIES.

By DAVID MILLER, Entomologist.

AMONG the insects which materially assist the agriculturist in the suppression of various insect pests are the hover or syrphus flies. Unfortunately, too little is known concerning these invaluable allies of mankind, and although they have been more or less studied in other countries little has been done in the past to discover the part played by the native species of New Zealand. As an enemy of the plant-lice or aphides, for example, they are probably of greater value than the well-known "ladybird" beetle.

Hover-flies form a conspicuous part of the insect-life throughout the world, and are well represented in this country, not so much in regard to the number of distinct species, but rather in the abundance of the individuals belonging to each species. They are brightly coloured insects, the predominating colours being black and blue with yellow stripes and spots, and from their unique resemblance to the colour, flower-loving habits, and, in certain cases, mode of flight and hairy covering, &c., of bees, they are usually confused with those insects. In consequence, the habit of stinging has been erroneously attributed to them. From their habit of frequenting flowers these flies, in the

adult stage, play an important part in plant-fertilization; they are, however, most beneficial on account of the predaceous habits of the larvæ or grubs of certain species. Hover-flies may be easily distinguished by their mode of flight; when on the wing they hang motionless as if suspended by some unseen means, and, if alarmed, dart off with such marvellous rapidity that the eye cannot follow until they again hang motionless as before. In size they vary from medium to large, some of the latter being as large as the common honey-bee.

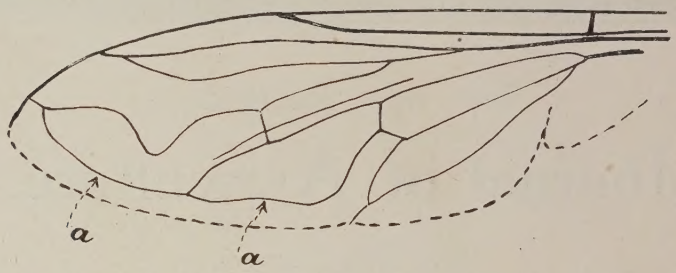


FIG. 1. DIAGRAM OF SYRPHID WING, SHOWING CHARACTERISTIC VENATION AT *a*, *a*.

Hover-flies belong to the order of two-winged insects or Diptera (from the Greek *di*, twice, and *pteron*, a wing), the second pair of wings present in other orders being extremely atrophied to form a pair of pin-shaped structures placed between the attachment of the wings and of the abdomen to the thorax. Although the presence of only one pair of wings will at once place the hover-flies in the Diptera, another means is necessary to separate them from the different divisions of this extensive group. By examining the wing (Fig. 1) it will be seen that

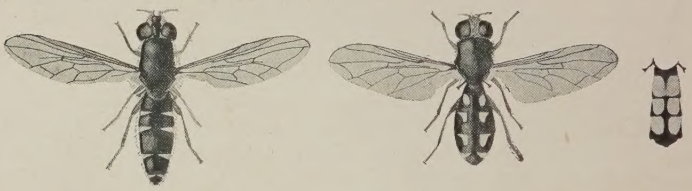


FIG. 2 (ON LEFT). NEW ZEALAND SYRPHUS-FLY (× 2).
FIG. 3 (IN CENTRE). FEMALE OF BANDED MELANOSTOMA.
FIG. 3*a* (ON RIGHT). ABDOMEN OF MALE (× 3).

the membrane is supported by a series of veins arranged in an unique pattern, which fact will give us a reliable key to identification; running almost parallel to and not far from the hind margin is a vein which unites the ends of others coming from the base of the wing. This arrangement is characteristic only of the hover-flies.

Although for the most part the syrphus-fly larvæ are beneficial, there are some species injurious to the health of man and domestic

animals. In many works on the subject it is often incorrectly stated that the hover-flies are always beneficial and never injurious. However, both the beneficial and injurious species agree in the tendency of the adults to bring about the fertilization of the flowers which they visit; it is in the larval or grub stage that they differ so much.

BENEFICIAL SPECIES.

On the whole, those species whose larvæ are predaceous, and therefore beneficial, are much smaller than the injurious forms, and the two most abundant and, as far as is known at present, most important species of the former class are the New Zealand syrphus-fly (*Syrphus novae-zealandiae*) (Fig. 2) and the banded melanostoma (*Melanostoma fasciatum*) (Fig. 3). Their larvæ devour large numbers of aphides and injurious caterpillars by sucking out the softer internal contents of these pests.

The eggs of these flies are deposited among or within easy reach of a colony of aphides, or upon the leaves of plants infested by caterpillars. These eggs are small and elongate, of a creamy white or yellowish colour, and from them emerge the peculiar-shaped legless larvæ (Fig. 4), which are wider towards the posterior end but taper to a point at the anterior end or head. Down the centre of the body may be seen a dark stripe which stands out clearly against the general yellowish colour of the larvæ. During locomotion these slimy creatures lift the posterior end and, drawing it forward, again apply it to the surface, so that the posterior segments are bunched up in the form of a swelling; simultaneously with the reapplication of the posterior end to the surface this swelling moves forward along the body in a wave-like manner until it disappears by the head being pushed forward to take up the advanced position, when the motion is repeated with marvellous rapidity.

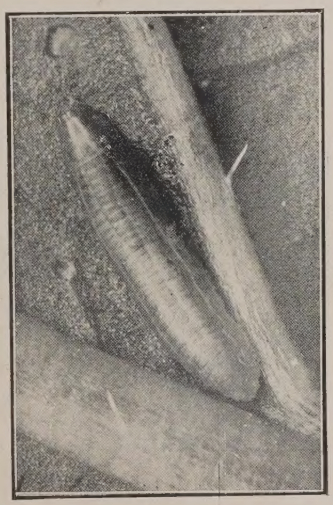


FIG. 4. SYRPHUS-FLY LARVA (× 8).

In search of caterpillars of diamond-back moth on under-side of rape-leaf.

On attacking their prey the front end of the larvæ is extruded in the form of a delicate trunk or proboscis, by means of which the body-wall of the victim is pierced and the succulent contents extracted by suction, the empty husk being the only remaining sign of the victim. If, for example, a colony of aphides be examined there may be seen many empty skins of individuals exterminated in this manner.

We need not look further than this warfare on the aphides to understand the immense value of these syrphus-fly larvæ. If the

plant-lice were left unchecked for a few generations there would, indeed, be but little chance for the well-being of any vegetation, as they are perhaps the most prolific of insects.

The female New Zealand syrphus-fly (*S. novae-zealandiae*) may be seen hovering around rose-bushes, vegetables, grasses, &c.—indeed, wherever aphides or caterpillars occur. She will frequently hover on to a plant to rest or feed, but if busy laying eggs will confine her whole attention to the operation. The eggs, which are elongate, narrow, and white, are usually deposited singly, and not in batches as is the case with the banded melanostoma (*M. fasciatum*), whose similarly coloured but shorter eggs are placed in double series (Fig. 5). The general movements of this fly are very similar to those of *S. novae-zealandiae*, the mode of flight perhaps being characterized by more abrupt transitions.

The New Zealand syrphus (Fig. 2) is an elongate species measuring about $\frac{2}{5}$ in. in length, and readily distinguished by the markings on the abdomen (or hind part of the body), the general colour of which is blue-black with eight triangular orange-red or cream-coloured transverse spots—four on each side—the apices of which are directed toward the centre and the bases along the sides of the abdomen; the thorax (which carries the legs and wings) is shiny bluish-green, and the legs are yellowish-brown; the wings are not coloured except for a long and narrow brownish spot placed about the centre of the front edge.

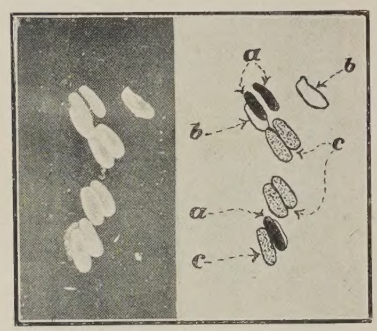


FIG. 5. EGGS OF BANDED MELANOSTOMA (MAGNIFIED).

(*a*) Freshly hatched larvæ; (*b*) empty eggs; (*c*) unhatched eggs.

The banded melanostoma (Fig. 3) is a little shorter, being about $\frac{1}{4}$ in. in length, and not quite so agile as the former species. Though they both frequent the same localities they are easily recognized by their colour. The banded melanostoma (female) has the abdomen somewhat oval and black, with eight large, more or less oval dark-yellow spots in a double row down the centre; in the male the abdomen is more rectangular, with only three pairs of spots, which are much larger, there being only a very narrow stripe (if any) of black between the two rows (Fig. 3*a*). An easy way to distinguish the sexes of these flies is by the position of the eyes. In the male the eye-margins are united on top of the head, but in the female are well separated.

Another species (*Syrphus viridiceps* of Macquart, *obesus* of Hutton) which is very common in Australia, and whose larvæ are aphis-eating, is sometimes found in New Zealand, particularly at Auckland, but is not yet well established.

The larvæ of two less abundant hover-flies (*Syrphus ropalus* and *S. ortas*) have been found attacking the caterpillars of the moth *Venusia*

verriculata (which cut notches from the leaf-margins of the cabbage-tree) (*Cordyline indivisa*) and the caterpillars of the two well-known moths (*Xanthorhoe praefectata* and *Melanchra steropastis*), which attack the leaves of the New Zealand flax (*Phormium tenax*). Further, the larvæ of the potato-tuber moth (*Phthorimaea operculella*), of the diamond-back moth (*Plutella cruciferarum*), and of an undetermined moth attacking the leaves of cabbage-trees, all fall a prey to the larval voracity of both the New Zealand syrphus-fly and the banded melanostoma.

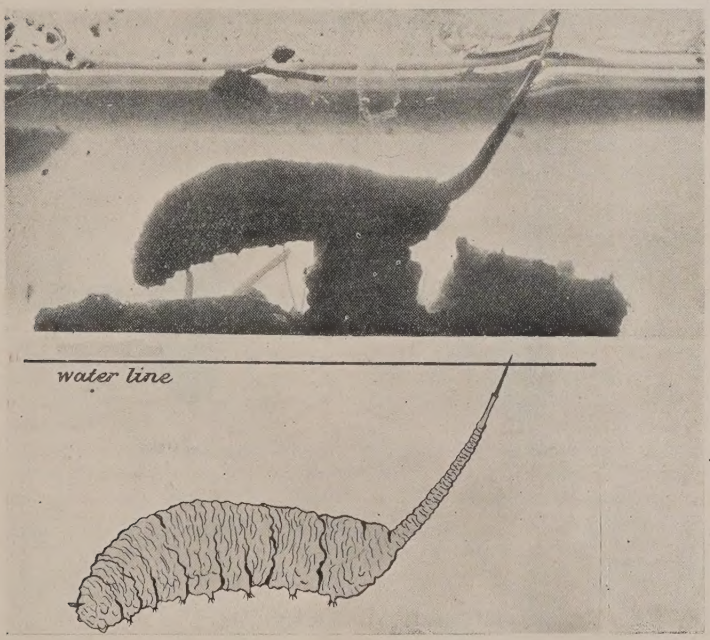


FIG. 6. PHOTO OF "RAT-TAILED" LARVA (ON TOP), AND DIAGRAM OF SAME (× 3). Note the telescopic breathing-siphon projecting above surface of water.

Besides the foregoing beneficial species there have been recorded two others which, together with a further ten to be described in the near future, no doubt will be found to destroy, in their larval stages, many forms of larvæ. But since these twelve species are at present mostly to be found in virgin country and only rarely in cultivated areas, it is probable that they still prefer their native environment to the cultivated or cleared country, until eventually compelled by the advancing reclamation of virgin territory to leave their native haunts or (it is to be feared in many cases) perish under the new conditions. Furthermore, unlike the cosmopolitan New Zealand syrphus-fly and

the banded melanostoma inhabiting both virgin and cultivated areas throughout the Dominion, most of these twelve species are at present considerably localized in their habitats.

INJURIOUS SPECIES.

On reviewing the larger injurious forms of hover-flies, of which there are about ten species now known in New Zealand, we find not only a marked difference in the build of the adult body, but also that the larvæ are totally different creatures, both in form and habits, to those of the beneficial species. Although very little damage is done by the injurious forms in comparison with the advantages derived from the beneficial, they are yet worthy of notice. The adults are large robust flies, some resembling a blow-fly in build and others the common bee; they frequent flowers exposed to the sun, and pools of water, ditches, &c., in which the eggs are deposited. The larvæ are the well-named "rat-tailed" larvæ (Fig. 6) found amongst slimy filth or on the leaves of water-weeds in ditches, &c. The body is cigar-shaped and stout, and arising from the posterior end is the long tail or breathing-

FIG. 7. COMMON HONEY-BEE (ON LEFT), AND EUROPEAN DRONE-FLY (ON RIGHT) (× 1½).

siphon—hence the "rat-tail"—which projects above the fluid in which they live. These larvæ have frequently been recorded as inhabiting the digestive organs of man and the domestic animals, entering by means of watercress and drinking-water. The signs of their presence are giddiness, abdominal pains, headaches, vomiting, &c., these symptoms being frequently ascribed to some other cause in such cases of larval myiasis.

Perhaps the most abundant of these injurious forms is the common European drone-fly (*Eristalis tenax*), now well established throughout this country, which species is nearly always mistaken for a bee on account of its remarkable resemblance to that insect (Fig. 7). If the two be compared, however, the mistake is easily rectified, since it will be seen that the drone-fly has only two wings and the bee four; also, the former has no sting, and the mouth-parts form a sucking-tube or proboscis.

Another injurious species of hover-fly from Europe occurs in New Zealand. This is the narcissus-fly (*Merodon equestris*), the larvæ of which infest narcissus and daffodil bulbs. The fly is densely hairy, and about the size of a honey-bee, which it closely resembles. The front part of the thorax (*i.e.*, just behind the head) and the apical part of

the abdomen are golden yellow, and the intervening parts black; the legs also are black, but the wings are uncoloured. The larvæ, which measure about ¾ in. to ⅞ in. in length, are greyish-yellow in colour with a transversely ridged surface, and taper toward the head, but are truncated posteriorly. They burrow within the bulbs, which they leave when ready to pupate in the surrounding earth. This species occurs both in Europe and North Africa. Recently some bulbs imported from Japan were received infested by the larvæ of this or an allied species, but as they did not develop beyond the pupal stage the species could not be determined.

[*Drawings and photos by David Miller and E. Bruce Levy.*]

CROPS FOR LAMB-RAISING.

AN inquiry was received recently on behalf of a number of settlers in the Kawhia district as to suitable autumn-fed crops for raising lambs for the breeding-flocks. They find that the most critical time is the period subsequent to weaning, during February, March, and April, when the pasture is usually so dry that the lambs receive a severe check. Cape barley has been tried by them, but found not to have the requisite carrying-capacity, while rape is regarded as altogether too heating and only suitable for fattening. The following advice, supplied by the Fields Division, embodies the experience of the Department's experimental farms:—

The drawback referred to in connection with rape is not so apparent when Buda kale is used, but, unfortunately, seed of this crucifer true to name is very difficult to procure, and for lamb-raising generally the main reliance must be put on soft turnips sown as follows: Lincolnshire Red Globe, Red Paragon, or Purple-top Mammoth, sown the first week in November, for February feeding; Hardy or Imperial Green Globe, sown in the middle of November, for March feeding; and Fosterton Hybrid, Long Keeper Yellow, or one of the Aberdeens, sown at the end of November, for April feeding. After this December-sown swedes may come in. One acre of a fair crop of soft turnips should carry forty lambs for two months. In districts where Aberdeen turnips and swedes are not reliable a trial of field-pumpkins is advised. These do not yield such large crops as turnips, but recent experiments indicate that lambs do exceptionally well on this crop. Sown from the middle to the end of October they are ready for feeding by the end of March. It is usually necessary to cart them off to a grass-paddock for feeding, and they require chopping with a spade, but this does not entail much labour. A paddock of Italian or Western Wolths rye-grass and red clover, sown during the first week in March, will provide feed in May and carry lambs well during the winter. If the paddock is not overstocked it will also provide a large amount of red-clover forage for lambs during the following late summer and early autumn, and the provision of such a paddock can be commended to all who undertake lamb-raising.

THE INDIGENOUS TANS AND VEGETABLE DYESTUFFS OF NEW ZEALAND.*

PART II.—EXPERIMENTAL (*continued*).

By B. C. ASTON, F.I.C., Chemist to the Department.

THE assay of the remainder of the samples of indigenous tan-barks taken during the season has now been completed, with the results shown in the following table :—

Lab. No.	Date collected.	Locality, County, and Altitude.	On Air-dried Bark containing 11 per Cent. to 14 per Cent. Water.			Calculated on Bark Dried at 100° C.	Remarks.
			Total Hot-water Extract.	Non-tannins.	Tannin.	Tannin.	
		Fagus (*Notnofagus*) *fusca*, Red Birch or Beech.	%	%	%	%	
K/26	..	Greymouth, Grey	10·7	2·9	7·8	8·9	
129	18/5/18	Rimutakas, Featherston, 1,760 ft.	18·1	4·6	13·5	16·0	Very rough bark.
		Fagus (*Nothofagus*) *Solandri*, Black Beech or Birch.					
K/169	1/6/18	Akatarawa, Hutt	16·2	5·5	10·7	12·8	Rough bark.
		Elaeocarpus dentatus, Hinau.					
K/115	13/5/18	Mamaku, Rotorua, 1,750 ft. ..	14·7	6·6	8·1	10·1	Old trees.
116	13/5/18	,, ,, ,, ..	13·1	7·9	5·2	6·0	Young trees.
		Weinmannia racemosa, Tawhero or Kamahi.					
K/128	18/5/18	Rimutakas, Featherston, 1,760 ft.	24·0	5·3	18·7	22·3	Old trees.
155	26/5/18	Eastbourne Hills, Hutt, 1,000 ft.	19·8	4·9	14·9	19·2	,,
171	1/6/18	Paekakariki, Hutt, 1,500 ft. to 2,300 ft.	24·9	5·5	19·4	23·3	Very old trees.
		Dacrydium cupressinum, Rimu or Red-pine.					
K/112	13/5/18	Mamaku, Rotorua, 1,750 ft. ..	12·4	4·2	8·2	9·8	
		Podocarpus ferrugineus, Miro.					
K/170	3/6/18	Paekakariki, Hutt, 1,500 ft. to 2,300 ft.	12·9	6·7	6·2	7·2	Very thick bark.
		Metrosideros robusta, Northern Rata.					
K/132	18/5/18	Rimutakas, Featherston, 1,760 ft.	13·6	6·1	7·5	9·0	Old trees.
154	26/5/18	Eastbourne Hills, Hutt, 1,000 ft.	16·0	6·7	9·3	10·8	
		Metrosideros lucida, Southern Rata.					
K/165	—/5/18	Westhaven, Collingwood ..	13·2	5·2	8·0	9·4	
		Fuchsia excorticata, Kotukutuku.					
K/153	26/5/18	Eastbourne Hills, Hutt, 1,000 ft.	7·1	4·1	3·0	3·4	Wood only.

* Previous parts of this series will be found in the *Journal* for August and September, 1917, and June, 1918. This investigation was prompted by the following resolution passed by the Dominion Conference of the New Zealand Farmers' Union, in July, 1916: "That on account of the scarcity of dyes at the present time the Government be asked to consider the advisability of getting expert opinion as to the dyes that could be extracted from New Zealand timber, which has been stated to contain enough dyes to supply the Southern Hemisphere." A recent report from the High Commissioner, published elsewhere in this issue, shows that this position with regard to the scarcity of dyes is now being met by the export under license of enough dyes from British houses to supply the bulk of the New Zealand demand.

We are now in a position to compare the results of this series of assays for tannin (published in this and the June *Journal*) performed by modern methods with those done by previous analysts quoted by old-time methods. The most striking discrepancy is the valuation of hinau-bark (*Eleocarpus dentatus*), to which was attributed a strength of 20 per cent. tannin-content, but which has been found in this Laboratory to yield at the most only half this quantity; whereas the pokaka (*Eleocarpus Hookerianus*), a sister species to the hinau, hitherto supposed to contain less, has been found to contain quite as much as the hinau.

Undoubtedly the richest bark in tannin from the commoner New Zealand trees is from the *Weinmannia* genus. There are two species, *W. racemosa* and *W. sylvicola*, but of the latter it has not been found possible to obtain samples, a deficiency which will no doubt be remedied in the coming season. The towai, or tawhero as it is called in the North Island, or kamahi in the South Island (*W. racemosa*), is proved to be very rich in tannin compared with the other native trees. The bark is always fairly thin even on the oldest trees, and the yield per tree is therefore likely to be small compared, for instance, with a similar-sized beech. There is some evidence that the age of the tree has some influence on the tannin-content, as a very thin and young bark contains only 8·2 per cent., compared with double this quantity found in older trees.

Of the ratas tested, the high percentage of tannin (18·5 per cent.) attributed to the northern rata (*Metrosideros robusta*) is not borne out by assays.

Of the "birches" or beeches (*Fagus* or *Nothofagus*), the foregoing assays show that there is far more tannin present in the bark, especially of the old trees, than was hitherto considered to be the case. The red-beech (*F. fusca*) would seem to be superior to the other species, and the old rough-barked trees are markedly superior to the younger smooth-barked trees. This species has many local names, and therefore it is somewhat difficult to briefly describe it in suitable terms, but it will be sufficient to say that the tree referred to is the largest-leaved New Zealand "birch." The results obtained for the *Fagus* family are much higher than those given by Skey, even allowing that he may have reported his analyses on the fresh bark and not on the air-dried or water-oven dried sample as is done in these articles.

Not enough samples have been obtained to allow of much being said of the *Phyllocladus* (tanekaha, or celery-topped pine) genus, but the matter will be further investigated. An abundant supply of seedlings could be obtained, and as it is a quick-growing tree there are economic possibilities, in both the timber and the bark, which make it worth studying.

For comparison with European, American, and Australian tannin-barks met with in commerce in the air-dried state, it may be stated that oak-bark contains 8 to 13 per cent. tannin, cork-oak bark 10 to 14 per cent., hemlock-bark 10 to 14 per cent., churco-bark 26 per cent., monesia-bark 32 per cent., mangrove-bark (*Rhizophora*) 9 to 33 per cent., alder-bark 16 per cent., larch-bark 6 to 8 per cent., mimosa-bark (*Acacia dealbata* and *A. mollissima*) 24 to 30 per cent.—(Allen's "Commercial Organic Analysis," vol. 3, part i, p. 47.) It must be remembered that

there are other factors affecting the value of tannin barks besides the tannin-content. The presence of injurious acids or other bodies which would affect the quality, or dyes which would give the tanned leather a colour which was either unsightly or unfashionable, have also to be taken into account, so that really practical tanning tests, using hide and the bark to be experimented upon, are necessary in order that the resultant leather may be fully investigated as to market value. The Commonwealth Advisory Council of Science and Industry in its first annual report (1917) records the result of its investigations on the sources of tannin in Australia (J.C.S.I., 1917, p. 1076). Out of 150 species of native trees analysed for tannin fifteen were found to yield over 20 per cent. tannin. The Council considers that the most promising solution of the shortage of tanning materials is the manufacture of tanning extracts, under which system all parts of the tree—leaves, twigs, and small branches—are utilized. But a difficulty arises in that the extracts contain gums and dyes which would decrease the value of the leather produced from the extracts. Chemical research in Germany having solved the problems of decolourizing and degumming, we find that large quantities of Australian bark were before the war exported to Germany for treatment, the concentrated extracts being returned to Australia. The Council suggests that these problems should be investigated in Australia. The export of tanning material from New Zealand to Germany was not unknown before the war, as referred to in an earlier part of these articles (*Journal*, Sept., 1917, p. 127). Excellent leather is made from the native beech bark of Nelson, but one would like to see efforts made to utilize the waste bark from rimu-milling and from tawhero or kamahi trees.

DYEING EXPERIMENTS WITH COPROSMA-BARKS.

Since the publication of the article in the June issue some additional experiments, which are of considerable interest, have been made with the four species therein mentioned.

In *Coprosma grandifolia* the principle yielding the purplish colours would seem to be extracted by alkali and not by acid. The acid and aqueous extracts of this bark yielded on wool very dark colours, which are not satisfactory, with chrome and alumina mordants. The alkaline extracts of the bark (which has previously been exhausted by warm acidulated water), in the proportion of 1 of fresh bark to 1 of wool, gives to chrome mordants on wool satisfactory purplish or maroon colours, alumina mordants yield orange to crimson, and stannous mordants orange to scarlet, all colours from the alkaline extract being fast to light and soap. The yellow wood of this species yields to chrome mordants with the alkaline extract a light brown on wool in proportion of 1 wool to 5 wood, and darker reddish-browns with a more concentrated dye-bath (1 to 12 up to 1 to 24), fast to light and soap.

Coprosma foetidissima dyes have proved disappointing in these light tests in which the dyed fabrics were exposed to the weather for one month, the handsome brown colours fading considerably in a few days' sunlight. This is true both of those colours extracted by acidulated water and of those by alkaline water on all three mordants—chrome, alumina, and stannous. There is some evidence, however, that

molybdenum will give fast colours. In one experiment a light olive-green was obtained which only saddened slightly on exposure to light.

Coprosma lucida gives with the alkaline extract acidified, prepared in the same way as the *Coprosma grandifolia* extract, red-brown with chromed wool and yellow to orange with stannous mordants, fast to light and soap.

Coprosma areolata proved to be different from the other three species in that the colouring-matter is easily extracted by boiling water.* This may mean either that the colouring principle exists as such in the juice of the bark (which is coloured brown throughout its thickness until the white wood is reached), or that, in boiling, the colouring principle is formed from other bodies present in the bark. In extracting the colouring-matter it is essential that the bark, which has an acid reaction, should not be allowed to come into contact with any iron, a very small quantity of which is capable of converting the substances in this species which give bright colours with tin mordants on wool into substances which yield only brown or dull colours. Neither should the aqueous extracts be kept any length of time before using, as the dyeing-power diminishes. With stannous mordants on wool the hot-water extract of this bark gives a colour which may be described as a scarlet to a crimson-scarlet or dark red. If the aqueous extract of the bark be boiled for a few minutes with dilute sulphuric acid, the dark reddish-brown liquid first becomes a light-red and then a dark-green colour with the production of a green precipitate. If the liquid be now nearly neutralized by caustic soda it will dye wool mordanted with bichromate of potash a brown-black to black colour which is fast to light and soap.

The economic value of these results cannot at present be foretold, but from a purely theoretical standpoint the results are extremely interesting. About a dozen of the commonest species growing near Wellington have been subjected to preliminary examination out of the forty species or so in the flora. Every one of these appears to have a distinct character with regard to the colour reaction of its bark to alkalis, and therefore it may be found possible to diagnose a species by means of the chemical characters. The colour of the inner bark (cortex) is generally characteristic for each species, and should certainly be used as a diagnostic character in differentiating the several species. As Mr. Cheeseman, in his painstaking paper "On the New Zealand Species of Coprosma" (Trans. N.Z. Inst., vol. 19, p. 218), states that, next to *Veronica*, *Coprosma* is the most puzzling genus in the New Zealand flora, this suggestion may be of service to systematists in New Zealand botany.

* This hot-water solution of the bark gives a good brown colour on wool, fast to light and soap, without the aid of any mordant—*i.e.*, it is what is called a substantive dye.

NOTE.—An abstract of these papers is being published in the September number of the *Journal of Science and Technology*, enclosing specimens of wool dyed with *Coprosma*. It was impracticable to do this in connection with the *Journal of Agriculture* owing to its large circulation.

Mr. R. E. Grimmett (Professional Cadet) has been of great assistance to me in carrying out the dyeing experiments.

Errata.—On p. 361 of June issue, for *Quintinnia serrata*, read *Q. acutifolia*; for K122, *Weinmannia racemosa*, read *Quintinnia acutifolia*.

THE GRASS-LANDS OF NEW ZEALAND.

(Concluded.)

By A. H. COCKAYNE, Biologist.

WEEDS AND SUCCESSIONS OF SURFACE-SOWN GRASS-LAND.

THE weeds of surface-sown grass-land can be divided into two main types—migratory weeds, and long-duration weeds. Migratory weeds are those that occupy the ground for a certain time and then, either through competition or through changes in the habitat of the ground they are occupying, become unfitted to their environment. Such an association as temporary pasture is really a migratory association. Migratory weeds of certain types are always found, and whenever fresh habitats are formed suitable for their development there will they be found.

On newly sown bush-burns the main migratory weeds found are Scotch thistle, various species of *Senecio*, fleabane, and various species of fireweed (*Erechtites*). On surface-sown grass-lands these weeds only persist from one to two seasons. On burnt forest that is not sown they may, however, persist for a longer period. To a very large extent they correspond in duration to that of Italian rye-grass, and in country where such weeds are likely to be prevalent Italian should always be included in the mixture, so as to set up an immediate competition against them.

Other types of migratory weeds appearing after the pasture has been down some years, and persisting for a varying period of perhaps from three to ten years, are such as the following: Inkweed (*Phytolacca octandra*), winged thistle (*Carduus pycnocephalus*), and certain other thistles, foxglove (*Digitalis purpurea*), Californian thistle (*Carduus arvensis*), ragwort (*Senecio Jacobaea*), and Capeweed (*Cryptostemma calendulaceum*).

With the exception of Californian thistle none of these weeds are conveyed to any extent in the seed that is sown, but they become dispersed over the ground by other means. There are, however, a large number that are regularly conveyed in the seed used, such as rib-grass, catsear, and many unintentional grasses, such as Yorkshire fog, hair-grass, and goose-grass. Few of these, however, cause any real change in the pasture. They do, of course, lessen the carrying-capacity, but they do not alter the general associations so as to render them virtually useless. At times, however, worn-out pasture may become almost pure catsear, but in this case the weed is not migratory but permanent. Capeweed often becomes dominant in pastures that are subject to periodical overstocking, such as holding and stock-accommodation paddocks.

With migratory weeds the essential fact to remember is that they persist only so long as the conditions to which they are subjected are

not altered. In the majority of cases the competition is between them and the sown grass-mixture constituents, and if the conditions are at all favourable for grass-development the weeds rapidly disappear. The rapid development of a thick compact growth of grass in many cases may even stop the development of the weeds in question. Generally, however, their seeds are in possession of the ground before the mixture is sown, so that any great delay between the burning and sowing should be avoided. This is really the reason why sowing almost before the ashes have cooled is recommended.

In many parts of New Zealand the longer-duration type of migratory weeds, which appear some years after the grass has been sown, generally owe their presence either to a totally unsuitable mixture being used or else to the seeding, owing to unfavourable conditions, failing to form a sufficiently thick sole to avoid the germination of such weed-seeds dispersed over the area. As soon as any alien species of vegetation of a long-duration type appears in a pasture, then the question whether it will become dominant depends on the character of the ground in relation to the type of mixture used and on the method of management that is adopted. Whenever the alien vegetation gets the upper hand a long-duration succession has occurred, which may be either injurious or useful. In all cases the direction of the succession will be towards fern-heath, shrub-land, or another type of grass-land.

Fern-heath is very commonly produced on surface-sown grass-land, and when this occurs grassing has again to be undertaken. The succession that often occurs is—sown grass becomes fern-heath, and the latter becomes manuka shrub-land; or sown grass becomes fern-heath, which becomes fern-heath and tutu shrub-land; and finally, after a very long lapse of years it may become of a forest type. Under proper management fern-heath may be turned into danthonia grass-land, or, if the land is good, may be regrassed with cocksfoot or some other type of mixture. Induced fern-heath produced on surface-sown grass-land appears in general more difficult to get rid of than natural fern-growth.

Shrub-land successions on grass-land are of many kinds, and can be here only briefly enumerated, as follows: Sweetbrier, broom, gorse, hakea, blackberry, tauhinu, manuka (generally with a preceding fern-heath stage, especially if the ground was originally forest-clad). On ploughable ground all the shrub successions can be eradicated by cultivation practices, but on unploughable land their control is often impossible.

A peculiar succession about which our knowledge is very limited is piripiri (hutiwai). Personally, I think piripiri is a succession leading to grass-land, as evidences of this can be seen on much coastal danthonia country which some years ago was extremely bad with this weed.

Piripiri succession can often be avoided by proper cattle-stocking. When, however, almost pure and in rough country it is practically impossible to control. There is no reliable information as to how long it will remain dominant, but it is safe to look upon it as a long-duration succession.

The main grass-land succession that takes place is that of danthonia. Associations in which danthonia has more or less replaced surface-sown mixtures occupy an immense area in New Zealand, running into some millions of acres. They are of all kinds, differing in the predominance

of danthonia. Some contain quite an appreciable amount of the constituents originally sown, others again are almost pure danthonia, and there are a host of transition stages. Apart from the rela ive abundance of danthonia there are many forms, especially of the *pilosa* type. These forms differ materially in the quantity and succulence of the herbage produced, and vary from grasses almost equal in value to cocksfoot to forms that are virtually valueless.

The following are some of the main associations in which danthonia plays a part :—

Lowland-tussock – danthonia. Example—The Port Hills, Christchurch.

Lowland-tussock replaced with danthonia—Portions of mid-Canterbury, on thin soils.

Rotation pasture replaced with danthonia – sweet vernal—Burnt Hill, Christchurch.

Cocksfoot-rye replaced with danthonia–cocksfoot—Wide areas in Wellington and Hawke's Bay Districts.

Fern-heath succession replaced with danthonia and danthonia–fiorin—Marlborough Sounds.

Manuka heath replaced with danthonia – rice-grass – *Poa pratensis* —Coastal sands.

Other types of danthonia country, the exact origin of which is not known, are abundant in the Auckland District, such as danthonia–red-top ; danthonia – rice-grass ; danthonia – bay-grass ; danthonia–rats-tail ; and danthonia–paspalum.

All these associations require careful study. By many persons danthonia and allied types of grass-land are looked upon as very bad, but it must be remembered that on the type of country on which they can be grown they remain permanent and yield more herbage than will any of the standard European grasses. They have, of course, many defects, but the wonderful way in which danthonia has covered hundreds of thousands of acres that otherwise would have reverted to useless vegetation, and to-day would be carrying no stock whatever, is perhaps the most remarkable feature connected with any of the grass-lands in New Zealand.

NOTE.—In the foregoing series of grass-land notes the writer does not claim to have dealt in any way exhaustively with the subject. The notes largely comprise material prepared for the teachers' farm-school held at Ruakura last summer.

The first milking Shorthorn heifers bred at Ruakura by the bulls Ransom, Lucifer, and Abram II are entering the shed this season, and promise well. Many more heifers by Melba's Prince are also being added to the herd this year.

A considerable area of Monarch swedes has been planted at the Marton experimental area for seed-production. The land, which is of a heavy and somewhat wet character, was worked into ridges 28 in. apart, and the bulbs put in 12 in. apart.

THE OHAI DISTRICT RAILWAY.

PIONEER ENTERPRISE UNDER THE LOCAL RAILWAYS ACT.

By A. W. RODGER, Chairman of the Ohai Railway Board.

In many districts throughout New Zealand railway facilities are urgently required in order that settlement may be encouraged and the local potentialities thoroughly and efficiently exploited. In other districts there may be considerable agitation for railway communication, while the benefit to be derived, both from the development and financial points of view, is a matter of doubt. To deal with these applications satisfactorily—by determining which are the urgent, which the less needful, and which the useless demands—has doubtless presented difficulties to the Government from time to time, and mistakes have admittedly been made. It may be presumed, therefore, that the Local Railways Act, 1914, was introduced and placed upon the statute-book in order that these difficulties might be minimized and the possibility eliminated of non-payable district railways being constructed at the cost of the general taxpayer. If a section of the community presents a petition for a railway to be constructed the authorities can now in effect say, "The Government is not going to undertake this work, but, if you have confidence in the ultimate result from the development and financial points of view, proceed under the provisions of the Local Railways Act, and if at any time after the railway is constructed the Government considers it advisable to acquire the undertaking it will do so, giving you twelve months' notice of that intention."

This is a distinct protection against ill-considered schemes being undertaken at the expense and risk of the general public; but probably the greatest usefulness of the Local Railways Act lies in the fact that while prior to its enactment most urgent calls for railway communication were neglected, owing to the Government for various reasons being unable to carry out the work, machinery is now available whereby those interested and who will benefit by the construction of the railway can undertake it themselves. These provisions must, as the time goes on, lead to many useful lines of communication being constructed, resulting in increased production and the general welfare of the community, and this is exemplified in the present results and future prospects of the Ohai Railway, the first to be constructed under the new legislation.

THE OHAI DISTRICT AND ITS RESOURCES.

The Ohai Railway District lies north-west of Wairio, the terminus of the Government branch line, Wairio itself being forty-two miles north-west of Invercargill. The district comprises 110,000 acres, of which 60,000 acres might be classed as pastoral. The remainder is

eminently suited for closer settlement, and, while the character of the land varies, none of it is poor, much of it being dairying-country equal to the best in Southland. Beyond the district already constituted large tracts of most useful country await development by means of a railway, and there is no reason to doubt that the Ohai Railway will eventually be extended through that country till it reaches and provides an easy means of access to Lakes Te Anau and Manapouri, which lie at a distance of some forty to forty-five miles from Ohai.

At present the approximate numbers of stock within the district are 45,000 sheep and 1,500 head of cattle, also 500 dairy cows supplying the Birchwood Dairy Factory, which turns out from 100 to 120 tons of cheese per annum. The agricultural land is capable of supporting, say, two hundred families, instead of forty-five as at present; and the pastoral country population could easily be increased in the same ratio, there being now only seven families thereon.

There are large deposits of high-grade limestone within the district, the use of which in conjunction with manures, made possible as a result of railway facilities, will materially increase the production of the country served.

In addition to the need of railway communication for land-settlement purposes, the coal-mining industry bulks largely in the proposition, as there exists within the area a very large deposit (proved over some 2,000 to 3,000 acres) of coal of a very fine quality, the bulk of it being equal to that mined at Kaitangata.

The existence of limestone in close proximity to coal opens up wide possibilities in the direction of new industries, and the development of the coalfield will undoubtedly result in the creation of a township of considerable size at Ohai, the present objective of the railway.

HISTORY OF THE ENTERPRISE.

The first steps to secure railway facilities were taken in 1913. At that time there was in course of construction a private tramway from Wairio to a point called Moretown, whence the output of coal from two mines could be taken. That tramway, however, was not being constructed on a route that could serve the district, inasmuch as, owing to the contour of the country, it could be extended beyond Moretown for only, say, a mile and a half; it could only serve two or three of the ten coal-mines being opened up; and, owing to grades, curves, &c., the disabilities of working the line were great. However, it was deemed expedient to afford the promoters of the tramway an opportunity of disposing of their undertaking, and the substance of the first petition to Parliament was that the Government should purchase and complete the tramway, and, further, that it should be extended as far as possible. The promoters of the tramway opposed the petition, and it proved abortive. Immediately thereafter a second petition was presented to Parliament that permission be granted to construct a permanent railway, being an extension of the Government line from Wairio, for a distance of six miles and a quarter, to Ohai, the ratepayers within the district finding the money and being responsible, by means of a rate upon their properties, for interest thereon and any loss that might be incurred in the working of the line. The Government was asked to give deben-

tures immediately for one-half of the cost of construction, and for the remaining half only when the undertaking proved to be profit-earning. The hearing of this petition by a parliamentary committee was completed on 4th August, 1914, the day upon which war was declared with Germany, and, in consequence, further consideration was postponed.

In November, 1914, the Local Railways Act became law, and without delay the ratepayers in the Ohai district presented the required petition to the Government, asking that it be declared a railway district within the meaning of the Act. Again the owners of the tramway already referred to and others objected, with the result that a Commission was set up to inquire into all the circumstances. The Commission sat in January, 1916, and on the proposal of the Commissioner an agreement was entered into whereby the Ohai Railway Board, when constituted, should, before constructing any other railway, purchase and take over the Wairio-Moretown Tramway at a price to be fixed by a Compensation Court. Thereafter the Ohai Railway District was gazetted, and the Board elected by the ratepayers in August, 1916. Numerous formalities had to be complied with and special legislation enacted to enable the Board to acquire the tramway, as the Local Railways Act does not provide for such a contingency. The Compensation Court sat on 4th and 5th June, 1917, and the tramway was paid for and taken over on the 22nd of that month.

The Board immediately took steps to carry out the extension of the tramway as far as possible—namely, one mile and a half—and this extension has just been completed. The Board has constructed a road giving access to the new terminus, and hutch-lines are being provided which will place upon the tramway the output of two coal-mines in addition to those which have hitherto been and are now being served by the original tramway. Thus, by means of the new road and hutch-lines, the ratepayers within the district, both settlers and coal-owners, will be served in a temporary manner until it is found expedient and possible to construct the permanent railway to Ohai.

Meanwhile three new coal-mines have been opened up three miles and a half from Wairio, on the route of the proposed permanent railway, and finance, rails, &c., having been provided for, the necessary formalities are now being completed in order that the construction of that portion may be carried out immediately.

Finance was in the first instance arranged by the issue of debentures for £25,000, which were hypothecated to one of the banks against advances under the clauses in the Local Bodies' Loans Act providing therefor; but since the Board decided to proceed with the construction of the first portion of the permanent railway arrangements have been made for a loan of £30,000 from the Public Trust Office, at 5½ per cent. interest, with a sinking fund of 1 per cent., which will redeem the loan in thirty-six years and a half. Further financial accommodation, if found necessary, will be arranged with the bank, as provided for in the Local Railways Act.

THE PRESENT POSITION AND THE FUTURE.

At time of writing 100 tons of coal per day is being conveyed over the acquired tramway and placed upon the market. The extension of the tramway now completed will assist the ratepayers generally by reducing

the cartage of requirements, comprising manures, seeds, merchandise, &c., and their products, such as wool, cheese, grain, live-stock, &c., while at the same time enabling a further 200 to 300 tons of coal per day to be placed on the market. It is estimated, moreover, that the construction of the three miles and a half of the permanent railway will give the Board the haulage and the public the benefit of at least another 300 tons of coal per day.

The first "Local Railway"—although as yet only in its infancy—may therefore lay reasonable claim to have already served a national purpose, inasmuch as it has not only opened up new country, giving an impetus to agricultural production, but will be the means of placing at the disposal of the people within the near future an additional 600 tons of coal per day. It must be admitted that these are laudable results, and it is noteworthy that they have been attained without the necessity of levying a rate. A rate was necessarily struck for the purposes of finance, but it has not been needful to collect one penny from the ratepayers.

THE WATCHWORD OF SELF-HELP.

The essence of the Local Railways Act is "self-help." The procedure followed to obtain railway facilities at Ohai has been given in detail in order to emphasize the fact that self-help was the watchword of the ratepayers of that district, even before the Act was contemplated. That that watchword has been adopted by Southland as a whole is manifested in another direction in its unanimous desire to generate electric energy and distribute it throughout the entire province without financial assistance from the Government. The Electric Power Boards Bill introduced into Parliament was drafted at the instance of the Southland League, and if enacted will have precisely the same bearing upon electrification that the Local Railways Act has upon railway communication. The assured success of the latter and the prospects of the former, judged by the enthusiasm of its people, should make Southland an example that other portions of the Dominion may well follow.

STOCK SLAUGHTERED.

THE following is a return of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary slaughterhouses throughout the Dominion during the year ended 31st March, 1918:—

—	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughter-houses.	Totals.
Cattle ..	78,831	211,319	..	51,150	341,300
Calves ..	11,364	3,116	..	816	15,296
Sheep ..	449,313	2,968,269	..	213,762	3,631,344
Lambs ..	66,012	2,609,134	..	20,297	2,695,443
Swine ..	40,806	36,708	59,725	15,297	152,536

In addition to the above, 27,004 pigs killed and dressed by farmers were inspected at butchers' shops.

ENSILAGE.

By W. DIBBLE, Assistant Agriculturist.

THE preservation of fodder plants by means of ensilage in order to ensure a permanent supply of succulent food for live-stock when pastures are bare or when supplementary crops have failed has long been recognized as a most valuable means of making the farmer independent of adverse natural conditions—in short, as the best insurance he can have against drought or pests.

Prior to the writer's arrival in New Zealand he had considerable and successful experience in ensilage-making in the west of England, and it is now thirty years since he made his first stack in the Dominion. At that time very few of our farmers considered the importance of ensilage in their general scheme of farming operations, but to-day its value is freely acknowledged, particularly in the Auckland and Taranaki Districts. Taking the Dominion as a whole, however, comparatively little ensilage is made, and a more general adoption of the practice is much to be desired, especially in the dairying districts and by dairymen supplying milk to cities. In Australia, Canada, and the United States of America the making of ensilage is regarded as an essential part of the year's operations. The New Zealand farmer can afford to take a greater risk than the farmers of those countries, but as long as he fails to make use of ensilage as a provision against the uncertainty of pastures and fodder crops he will fail to fully benefit by the better climatic conditions of this country.

There is some misconception regarding the feeding-value of ensilage, and it should be borne in mind that its quality is chiefly determined by the material from which it is made. Inferior grasses, and weed-growths, such as Californian thistle and even goat's-rue, can be made into fair ensilage, but naturally the feeding-value of such is very much lower than that of ensilage made from good grasses and clovers, or from maize or lucerne. Some, again, consider that ensilage does not possess the same nutriment as the material from which it is made, and that it is even inferior to hay. This idea is quite erroneous. As a matter of fact, by the preserving of a plant in the form of ensilage its feeding-value is increased. It is admitted that the value of a food is determined by its degree of digestibility, and when green material is preserved in the form of ensilage the fermentation it undergoes renders soluble a greater proportion of its nutritious elements, thereby making them more easy of digestion by the animal. It has been stated by competent authorities that the changes effected in the composition of a plant while in the process of ensilage-making are similar to those which take place in the first stomach of ruminants. This, no doubt, is the reason why cows when fed on ensilage milk so remarkably well.

For feeding purposes first-class ensilage is decidedly superior to hay. Good ensilage will not impart a bad flavour to milk: on this point I can speak from seventeen years' experience in milking for a city supply. When feeding ensilage to dairy cows during the early spring months it should be given in the morning, and hay in the evening. During the summer months the cows may be given as much ensilage as they will consume. For fifty cows 40 tons of ensilage will be sufficient for forty days, allowing each a ration of 20 lb. twice daily. A cubic foot of ensilage should weigh from 40 lb. to 56 lb., according to the material from which it is made.

ENSILAGE MATERIAL.

The first consideration is what can be used for silage. There is usually surplus grass in spring and early summer. A field may be closed for haymaking, and if the season prove unfavourable and unsettled the grass may be converted into silage. Grass, abundant on the farm in a wet season, can be cut and stacked almost without removing stock from the enclosure. All roughage that would otherwise be wasted can be used. Then comes the question, Should crops be specially grown for silage? The answer is, decidedly, Yes. Crops that ensile and will only occupy the land for a short time are oats, Italian and Western Wolths rye-grass, tares, and clovers. The leguminous plants should preferably be grown, mixed with a large proportion of Italian rye-grass. Then come sorghums, millets, and—most useful of all—maize. Of these crops some will probably be fed green, and all that may not be used will provide excellent ensilage. All the crops mentioned can be well recommended; they have been proved by many progressive farmers, and tested on our experimental farms.

Probably there is no better material for silage than lucerne, and combined with maize it makes an ideal balanced ration. Apart from its great feeding-value lucerne should especially appeal to the farmer as affording probably the most economical means of obtaining an annual supply of valuable silage. The owner of a lucerne-field will find it of great advantage to utilize the first cuts of the season for ensilage, as at that period the weather is generally unsuitable for haymaking; indeed, without utilizing them in this manner it will be often found impossible to make use of these early spring growths, coming as they do when abundant feed for the stock is available in the ordinary pastures; but by converting them into ensilage what would otherwise be a direct loss may thus be converted into valuable fodder, to be available when the lucerne is dormant in winter.

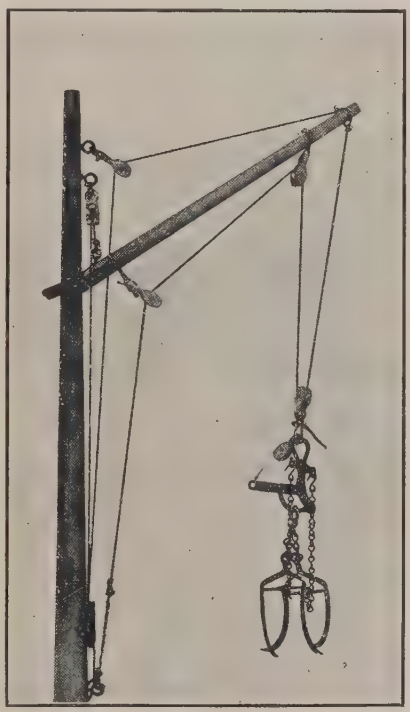
Following are some varieties of maize recommended for ensilage purposes: Early—Longfellow, Ninety Day, Funk's Yellow Dent, Early Red Hogan, and Early Leaming. Late—Eureka, Craig Mitchell, Eclipse, Yellow Morgane, Red Hogan, Boone County Special, Hickory King, and White Horse-tooth. Maize should be sown in drills 28 in. apart, so as to permit of intercultivation.

HARVESTING FOR ENSILAGE.

In harvesting for ensilage grasses and clovers should be cut with the mower and gathered by means of a heavy hay-rake. Set the teeth to the ground, and when the horse has advanced six paces tip the rake and hold it until another six paces have been covered, then drop the

teeth and rake up again. Continue this process to the end of the swathe, then return over the same ground, raking up what was left in the first place. By this means the crop will be raked clean with a minimum expenditure of time and labour, and the work can be done in either wet or dry weather. Crops such as Italian rye-grass, oats and tares, or oats, wheat, lucerne, and prairie-grass mixed, may be harvested with a reaper-and-binder, which will facilitate handling. Maize is best cut and handled with a special corn-binder.

Considering the question of when to harvest for silage, the best guide is to mow the grasses when the principal varieties are flowering, and lucerne and clovers at the same stage. The actual periods will vary with locality and season, from early in November to late in December. It is an advantage to mow the grass early. Early-mown pastures recover quickly, the exposed roots of the grass being allowed to recover and grow before the heat of summer parches the soil. Thus converting the pasture-grasses into silage instead of into hay is a factor of very great benefit to the pasture. Clover naturally varies its flowering-time with variety, date of sowing, and season, and similarly with other crops mentioned. Tares and peas should be harvested when the flowers are full and pods are beginning to form; oats as the milk in the grain is thickening, or sufficiently early that all is stacked before the straw loses its succulence; maize when the corn in the cob is well formed. The sorghums, millets, and maize provide comparatively poor-quality ensilage until the commencement of ripening is present; at that stage maize provides the best silage.



A SIMPLE DERRICK. (See page 152.)

THE STACK SYSTEM.

The stack method of ensilage-making is the simplest, and is the most suitable for present conditions in New Zealand. It is therefore recommended in the first instance. Many farmers appear to believe that the making of stack ensilage is difficult. This is not so; actually the silage-stack should be a less source of anxiety than the haystack. Greater experience is required for the conservation of hay than of

silage. The haymaker is at the mercy of the weather; the silage-maker is independent of these conditions.

The site for the ensilage-stack should be on a level piece of land, with facilities for drainage if necessary, and in a position convenient for the economical feeding of the stock. Owing to the strong odour from the ensilage during the curing process it is not desirable that the stack be erected near a building used for milking operations.

The stack should be set out nearly square, and spaced according to the quantity of green material available. Thus, for 25 tons the space required would be 14 ft. by 14 ft.; for 60 tons, 18 ft. by 16 ft.; for 100 tons, 24 ft. by 20 ft.; and for 130 tons, 30 ft. by 24 ft.

The ordinary method of stack-building should be reversed, the sides of the stack being kept higher than the centre, carried up perpendicularly, and the corners well raised and perfectly firm. When the weight is applied on completion of the stack the sides and corners will be pressed down level with the centre of the stack. In keeping the stack perpendicular and the corners square, frequent rakings with an iron-tooth garden-rake will be found serviceable when the material is loose, but if it is bound in sheaves a sickle may be used in trimming the sides where necessary.

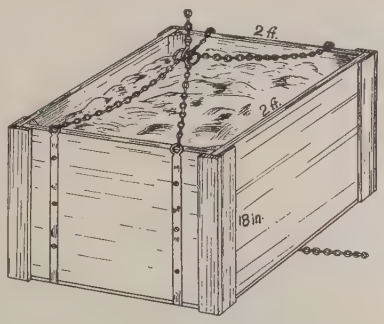
The temperature is the first factor of ensilage-making. If the material is cut and stacked when in its most succulent stage, and not given sufficient time for the required heat to generate as the stack is being built, the temperature will probably register only from 80° to 110° F., and sour ensilage will result. This is not so palatable to stock as sweet ensilage, but they will eat it and thrive on it, and it is equally suitable for using during a period of drought. Sour ensilage, however, is not recommended, on account of its strong odour and the unpleasantness in handling it.

Sweet green ensilage is preferable for milk-production; it contains sufficient moisture, and is readily eaten by all classes of stock. The temperature required for making it is from 125° to 130°. If the temperature should range from 140° to 160° the result will be sweet brown ensilage, and although this is palatable to stock it is not of the same feeding-value as sweet green ensilage. Should the temperature rise above 160° the material becomes black and burnt, and therefore practically useless as a food for stock.

The temperature can, within limits, be regulated from time to time, and when building the stack care should be taken not to allow the heat to generate nearer than 3 ft. below the surface, otherwise mould may develop.

In building the stack a layer of from 6 ft. to 8 ft. in depth should be put together in the first place to ensure generation of the requisite heat. Enough grass or other crop to provide material for this should be cut and stacked immediately. The following day this will probably have heated to 130°. If it does not heat to 125° delay adding more material for a day, or even two, to allow the temperature to rise. When the temperature has risen to the necessary degree it will be sufficient to add a layer of from 3 ft. to 6 ft. of fresh green material each day until the stack is completed. Note that extra pressure decreases the heat, and *vice versa*.

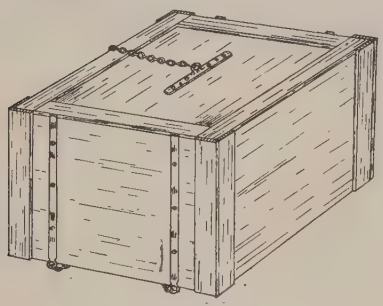
To take the temperature set perpendicularly in the stack a 1 in. galvanized-iron pipe, 6 ft. in length and pointed at one end. A round dairy-thermometer with a string attached may thus be lowered into the stack from time to time, a cork placed in the top of the pipe, and the temperature ascertained in a few minutes. The pipe may be dispensed with during working-hours, inserted again in the evening, and the temperature noted the following morning.



BOX FOR LIFTING SOIL FOR WEIGHTING STACK. (See page 153.)

It is as well to emphasize that the temperature should be maintained at between 125° and 130°. If it remains less than 125°, allow, as already stated, an interval of a day or more in the building of the stack; but if it exceeds 130° cut and stack more material until the temperature is reduced to the required degree. Experienced silage-makers permit a wide range without anxiety, and some dispense with the thermometer altogether. It will, however, be advisable, as a rule, to rely upon the indications of this appliance.

The ensilage may be greatly improved by the addition of coarse agricultural salt, in the proportion of 1½ lb. to each ton of green succulent material, or 2 lb. to each ton of wilted or overripe material. In the latter case the addition of the extra amount of salt is of assistance in restoring the material to its normal condition. It will be found that stock thrive better on well-preserved ensilage, and that they will waste very little, even though good grass be available.



METHOD OF USING THE CHAIN FOR TIPPING OVER THE BOX.

Although there is a great subsidence in an ensilage-stack the height at any one time should not exceed 18 ft. or 20 ft. The effect of wind must be borne in mind, for a strong wind blowing from one quarter will drive the heat through the stack, with the result that it will have a tendency to subside on the lee side. Therefore the higher the stack the greater the danger from this cause. If heavy winds are experienced while building, it is recommended to hang a tarpaulin over the side of the stack exposed to the wind: this will allow of the whole mass settling evenly. Winds will have little or no effect when the weight has been applied on completion of the stack.

For conveying the material to the stack either sweeps, sledges, or low-built wagons may be used, according to the relative positions

of the stack and the crop. A simple sledge may be constructed by building a platform 8 ft. by 8 ft. of 9 in. by 1 in. rough timber on 12 in. by 3 in. runners, and for easy running the latter should be shod with iron. To expedite the work two or three sledges may be used, according to the size of the paddock, with a man and two horses to each sledge. Low wagons are very convenient when crops have to be carted any distance to the stack.

When sledges are used it will facilitate the work and probably save a team and a man if the following device be used: Erect by the stack two stout posts between which the sledges when loaded can be drawn. Attach to one of the posts, about 18 in. or 2 ft. from the ground, a strong rope 16 ft. in length, which, if stretched across in front of the load and fastened to the other post a little above the level of the floor

ENSILAGE-STACK, SHOWING FRAMEWORK FOR WEIGHTING MATERIAL.

of the sledge, will, when the horses are again driven forward, cause the load to be left on the ground ready for hoisting on to the stack.

There are several elevators on the market, but a simple derrick is very serviceable. It can be constructed by a handy man on the farm, and the necessary material is procurable at the majority of country towns. The main pole should be from 30 ft. to 36 ft. in length, and the diameter 8 in. at the base and 4 in. at the top. The boom should be 18 ft. in length, 5 in. in diameter at the base and 2 in. at the top. Three guy-ropes are required, one 120 ft. in length and two of 65 ft. There should be two boom-ropes, the bottom one 65 ft. and the top one 75 ft. in length. The hoisting-rope should be of 3 in. manila, 135 ft. in length.

On completion the stack should be weighted with earth taken from each side of the stack—not the ends. The stack must be made level on the top surface, and then covered with a platform of third-class timber, placed across the stack, with a fairly strong framing, 18 in. to

20 in. high, erected around the edges, to hold the soil for weighting. The corners of this framing should be braced, and three plain wires run lengthways and crossways, and securely stapled to the platform in the centre. This will hold the structure together when the pressure is applied.

The following specifications of timber required for platform and framing on top of stack to hold the weighting-material will be found useful :—

STACK 14 FT. BY 14 FT.

			Ft.	in.
Rough boards	..	..	196	0
3 x 2	4/14, 4/15	..	58	0
3 x 1	4/4, 20/1¼	..	10	6
9 x 1	2/14, 2/15	..	43	10
			308	4

STACK 18 FT. BY 16 FT.

			Ft.	in.
Rough boards	..	..	288	0
3 x 2	4/18, 4/17	..	70	0
3 x 1	4/4, 20/1¼	..	10	6
9 x 1	2/18, 2/17	..	53	0
			421	6

STACK 24 FT. BY 20 FT.

			Ft.	in.
Rough boards	..	..	480	0
3 x 2	176 ft. running	..	88	0
3 x 1	4/4, 20/1¼	..	10	6
9 x 1	4/12, 4/11	..	69	0
			647	6

STACK 30 FT. BY 24 FT.

			Ft.	in.
Rough boards	..	..	720	0
3 x 2	216 ft. running	..	108	0
3 x 1	4/6, 24/1¼	..	14	0
9 x 1	4/16, 4/12	..	74	0
			916	0

Two boxes are required for hoisting the earth to the top of the stack, one being filled while the other is being hoisted. These should be 24 in. square by 18 in. deep, strongly made out of 9 in. by 1 in. timber, and to prevent accidents they should be braced together with strong hoop-iron. (See illustrations on page 151.)

In order to regulate the subsidence of the stack it is necessary to have a man levelling the soil on the platform. Should the stack have a tendency to lean either way, it may be made to settle upright by depositing extra weight where required. The soil should be kept well to the edge, as it is there the principal weight is required to make the sides as compact as the centre, thereby ensuring the top of the stack being level. The depth of the earth on the platform should be from 20 in. to 24 in.

The ensilage can be fed to stock as soon as the temperature is even in the stack and the latter has settled. This should be in about two months. A well-made stack will continue improving for a considerable period. When opening up the stack commence at one end by dividing it into three sections and taking out a corresponding cut, say, from 5 ft. to 6 ft. square. Throw the earth from the first section back into the trench from whence it was taken, then cut away the framing and remove the boards from the top of the silage. The wires will hold the remainder of the framing together, and the boards, being placed across the stack, may be easily removed. The silage may then be cut with a sharp spade or hay-knife. It should be well shaken up when being forked on to the dray, so that stock may get a fair sample and be encouraged to take it readily.

The cost of manufacturing stack ensilage depends considerably on the crop from which it is made and the labour and appliances available. On an average, the cost per ton of cured material should be from 3s. to 5s.

(To be continued.)

CITRUS-FRUIT CULTURE IN NEW ZEALAND.

ADVICE TO GROWERS.

By J. W. COLLARD, Orchard Instructor, Auckland.

THE cultivation in New Zealand of the lemon and orange and other members of the citrus family has not received from orchardists in the past the attention of which these fruits are worthy. Not perhaps until the year 1913 or 1914 did it become fairly recognized that in considerable areas of the Dominion where climatic conditions are favourable this branch of the fruitgrowing industry offered good prospects. At that period citrus-culture received a decided impetus, plantings have continued to a considerable extent up to the present time, and it now bids fair to rank among the leading classes of fruit-production in North Auckland.

The Northern Peninsula has for several years past been the chief orange- and lemon-growing district in New Zealand, Whangarei, with its congenial subtropical climate, being the centre of production. Here are established on volcanic and alluvial soils groves of both the sweet and bitter oranges, also of lemons, ranging up to twenty-five years old. The trees at this centre are producing large crops, thus proving the suitability of the conditions for these members of the citrus family. However, throughout the Peninsula where suitable conditions exist it has been proved that oranges and lemons thrive, and in most cases are crop-bearing. Although the North of Auckland is favoured by climatic conditions, other localities, where very heavy crops are not experienced, notably Tauranga and Poverty Bay, have proved their suitability for this purpose. In the last-mentioned district a considerable acreage has been laid down during the past two seasons. These plantings are chiefly lemons, and, generally speaking, the trees are doing exceedingly well. Several parts of Nelson District, such as Golden Bay, have also proved naturally favoured for citrus-culture, especially lemons. Judging from my own observations, I estimate that the plantings of lemons in the Auckland District this season are considerably more than double those of last season's. In the Henderson district alone approximately 1,020 trees have been planted, irrespective of a considerable number of oranges which I know to have been put out, principally of the Poor Man variety. In other districts adjacent to Henderson large plantings have also been undertaken; one company alone having put out some 2,000 trees within the past three years.

It will thus be seen that within the next few years we are going to have a very large increase in the production of lemons. Up to the present time those growers who have been fortunate enough to be producers have received fair prices for their fruit on the local market. Now, the New Zealand market is not by any means fully supplied by local growers, either in Auckland, Wellington, or the large centres of

the South Island. This is shown by the large quantities of lemons and oranges imported into the Dominion from Australia, Italy, America, and the Islands. Following are the figures for the year 1915–16 (which period is given as more nearly representing pre-war trade conditions than does the present time, when shipping difficulties have artificially restricted the volume of imports) :—

Port of Entry.	Oranges. Cases.	Lemons. Cases.
Auckland	79,842	2,337
Wellington	40,875	9,161
Christchurch	23,128	3,039
Dunedin	16,323	1,855
Bluff	2,314	570
Totals	162,464	16,962

Lemons are subject to an import duty of 1d. per pound throughout the year.

Taking the Auckland District plantings of lemons as approximately 3,000 trees, in seven years' time, at the low estimate of four cases per tree, we should have 12,000 cases to deal with. Out of this, of course, an allowance has to be made for a number of trees that will not be properly attended to, but the calculation indicates roughly a deficit only of some 5,000 cases to be made up to equal the whole of the New Zealand imports on the present scale. With the advent of better facilities for lemon-curing, and when our local market is fully supplied, there are many uses to which this product may be put in the Dominion; and it is also quite probable that, given sufficient and efficient organization by fruit-growers, a profitable and expansive export trade might be opened up with Europe, Great Britain, or America. Spain, Italy, Turkey, Egypt, and the Canary Islands are the chief producers for European markets, and the United States imports annually about 60,000 tons of lemons. The European demand is naturally an increasing one, and the room for expansion in production in Mediterranean countries is limited.

Chief among citrus by-products are the following: Lemon-juice, citrate of lime, oil of lemon, citric acid, and candied lemon-peel; orange-flower perfume, essence of extract of orange-flowers, essential oils of orange, the oil of orange-flowers, tincture of orange, orange-wine, &c. At the present time a large quantity of raw lemon-peel is imported into this country for the manufacture of candied lemon-peel. This alone offers a good field for development, as we could well supply this peel from our own groves.

SOILS AND SITUATION.

The cultivation of citrus-fruits may be regarded as an occupation requiring especial care and knowledge from the time of planting to the marketing of the crop, but this is not without its reward, for no other class of tree so readily responds to correct treatment.

Very careful consideration is necessary in the selection of suitable soils. Good drainage is essential. Although the climate of any one district may be good, the soil will possibly leave much to be desired, and *vice versa*. An open, well-drained subsoil is desirable, preferably with a deep top-soil of friable loam. Soils consisting of fairly shallow

alluvial or loam over retentive grey or yellow clays require artificial drainage. Those of very sandy loam over hard sandstone, or a shallow loam over a shallow sandy clay with sand or ironstone hard-pan, are quite unsuitable, as also are heavy yellow clay and pipeclay soils over grey or blue clay subsoil. Therefore in this relation the greatest success, generally speaking, may be expected on soils of a uniform deep sandy loam over a porous clay. Such will ensure against an excess of moisture during the wet period of the year, and yet retain sufficient moisture throughout the dry season for the requirements of the tree. Considerable areas of such soils are found on the gum lands in the North of Auckland. Volcanic and semi-volcanic soils over porous and semi-porous clays are most suitable to the growth of the citrus family, and the type of fruit produced on them is considered excellent.

Citrus-trees require a well-sheltered position, preferably with a north-east aspect, sheltered from south-west and easterly winds. Advantage should be taken of a situation free or nearly free from frost. Much damage may be done by frosts to young growths, especially in young trees. The orange will be found more hardy than the lemon in this respect.

STOCKS.

This is a question of vital importance to the commercial grower. The unsuitability of a stock to local conditions has been a factor in large losses by orchardists. The old rough lemon was chiefly used in the past as a stock, but at an early age, in some classes of soil, it is susceptible to attack from root-rot. In New Zealand the greatest success has so far been obtained from the use of the sweet orange (*Citrus dulcis*) as a stock. This produces a vigorous tree on well-drained soils, but it is subject to root-rot to a greater extent than is the sour orange (*Citrus bigaradia*). The latter is claimed in some parts of Australia to be the most suitable stock, producing a tree of good growth and standing irrigation conditions extremely well. A stock which has earned a reputation commercially in Florida and California as generally suitable for heavy classes of soil is *Citrus trifoliata*, a Japanese deciduous species. Results, however, from the use of this stock in Victoria have been unsatisfactory, and, so far as New Zealand is concerned, sufficient trial has not yet been given to it. If proved suitable to existing conditions it would largely solve the question of suitable soils, &c., especially on the northern gum lands.

PROPAGATION.

Citrus-trees are usually propagated by budding on to seedlings. These may be planted in spring, and are generally raised in boxes, or, if a large number be required, in seed-beds. The soil should be a good rich loam, and kept sufficiently moist to ensure successful germination of the seed. The seed should be selected, and no badly developed, malformed seeds should be sown. Seeds are separated from the fruit either by squeezing them out by hand or by allowing the fruit first to rot, and in each case washing the pulp from the seeds through a sieve afterwards.

A better germination is obtained if the seeds are sown while moist, and care should be taken to prevent them becoming too dry before planting. The seeds may be sown either in drills or broadcast, the former method being recommended. When sowing in drills the rows

should be spaced from 8 in. to 9 in. apart, and 3 in. to 4 in. between each seed. Cover with soil to a depth of about 2 in. Maintain sufficient moisture in the bed, and provide reasonable protection from the ruling elements.

If good growth has been obtained the seedlings may be transplanted at twelve months into the nursery rows. A good dressing of complete fertilizer should be carefully applied to the nursery at the time of transplanting, care being taken to incorporate it well with the soil. Plant the seedlings in rows about 4 ft. apart and 12 in. to 15 in. apart in the rows. Keep the plants growing throughout the season by thorough and clean cultivation.

During the following summer (that is, when the seedlings have been transplanted about fifteen months), when the sap is flowing freely, budding may be proceeded with.

PREPARATION FOR PLANTING.

On whatever class of new land it is decided to plant citrus-trees it will generally be found necessary to commence the preparation of the land at least one year previous to the time at which it is proposed to plant, and this only when the necessary wind-shelter has been provided. The shelter should be well established before any idea of planting is entertained.

In cases where new country has to be broken in and shelter provided it is advisable to break up during the first autumn the whole area selected for the grove, get the necessary shelter planted during the early spring months, let the remaining area lie up in the rough for twelve months, and then harrow down and cross-plough. In the following autumn plough again, harrow down well, and plant a cover-crop of oats to be ploughed in during the spring. Work the land up well with the disk and tine harrows during the summer, and plant a crop of some legume to be ploughed in in the following autumn, when the land is ready to receive the trees—provided the shelter has made sufficient growth. The oats will serve to break up and sweeten the soil, and the legume to add nitrogen and humus. When the top-soil is not very deep, and the subsoil compact, it will be necessary to sub-soil in order to provide for efficient drainage and to allow the roots to penetrate sufficiently.

Where practicable intending planters should select their own trees from the nursery. In cases where they do not grow their own there is nothing to be gained and much time and money lost by planting inferior trees. Although the Nursery Regulations under the Orchard and Garden Diseases Act, brought into operation during the 1916 season, provide against the distribution of disease-infected stock, the grower has his own interests to watch in the matter of selection of a right class of stock.

PLANTING.

The methods of planting deciduous fruit-trees adopted in New Zealand—namely, the square and the triangular systems—apply also to the planting of citrus-trees. The general rule is to plant at distances from 20 ft. to 28 ft. apart on the square, stock, soil, situation, and variety being the guiding factors in this respect. It is not desirable to plant citrus-trees closer than 20 ft. apart, and, with the exception of certain varieties, a greater distance than 28 ft. is not necessary.

Plantings should be carried out for preference during the autumn months, while there is still some warmth in the soil. This encourages root-formation during the late autumn and winter, and puts the tree into a position to take up good growth with the advent of warm spring weather. Much better results are obtained by autumn than by spring plantings.

If manure is applied at the time of planting it should be well incorporated with the soil, and not allowed to come in direct contact with the roots. Blood-and-bone, at 2 lb. to 3 lb. per tree, is recommended for this purpose.

Any extra time spent on especial care in the planting-out of young trees is time well spent, and will be fully repaid in the future.

MANURES.

The four essential constituents of the soil necessary to the productiveness and general fertility of the citrus-orchard are lime, nitrogen, phosphoric acid, and potash. Lime is required both for the health of the tree and the quality of the fruit. Nitrogen is largely required for the growth of the tree, but caution should be used to avoid an oversupply, which causes rapid and soft growth liable to disease, decreased productiveness, and an increase of the rag of the fruit. Potash is present in most soils, but requires to be maintained. It plays an important part in the formation of fruit and wood, decreases the thickness of rind, and bears influence on the keeping-qualities. Phosphoric acid has an important function in the formation of fruit, and consequently the productiveness of the trees.

Computations made from fertilizer analyses of citrus-fruits by the University of California Experimental Station show that all kinds contain practically the same percentage of fertilizer ingredients. The averages of the five experiments carried out, including fruit of mandarins, kumquats, pomeloes, sweet oranges, and lemons, showed that the fruit contained 0·055 per cent. phosphoric acid, 0·249 per cent. potash, and 0·149 per cent. nitrogen. The weight of fruit taken in each experiment was 80 lb., being the average weight of a Californian citrus-box. The weight of ten cases would thus be 800 lb., and this amount of fruit would remove from the soil 0·550 lb. phosphoric acid, 2·490 lb. potash, and 1·490 lb. nitrogen.

In order to avoid soil-depletion these are the losses which must be made good for each crop of ten boxes. Provision, of course, should be made for a variable and unknown quantity of plant-food which leaches from the soil; besides which, the tree must have a sufficient supply to enable it to add new growth in root, branch, and leaf. A fair approximation, covering the fertilizer removed in the fruit and that lost by leaching and required for new growth, would be two or three times the amount estimated for every ten boxes of fruit.

The fertilizing of citrus-trees is more or less a local matter; it is almost impossible to reduce it to a matter of actual figures, and each grower must determine for himself how much manure his trees require, and how much it is economical to use. It has been observed that where commercial fertilizers are largely used the grower who fertilizes heavily and uses the proper material generally meets with the most success. This perhaps is not only the result of the additional fertilizer applied, but because a liberal policy along this line leads him to give greater attention to all details connected with the care of his trees.

Nitrogen may be applied in the form of green manure, blood-and-bone, nitrate of soda (16 per cent.), sulphate of ammonia (21 per cent.), or dried blood (14 per cent.). Blood-and-bone is chiefly used; nitrate of soda and sulphate of ammonia, being quicker-acting, are applied mostly for forcing growth. Although the trees require a full supply of nitrogenous manures, an oversupply often gives the opposite result, causing weakly growth at the expense of the crop and rendering the trees very susceptible to attacks of fungi.

Phosphoric acid may be supplied in the form of superphosphate or bonedust (22·26 per cent.). The forms in which potash may be supplied are sulphate of potash (26 per cent.) and muriate of potash (50 per cent.).

Manures are best applied in the early spring. A good formula to use is two parts of blood-and-bone, one of super, and one of potash. Owing, however, to the present scarcity of potash it is likely that many growers will have to cut it out this season. All manures should be well spread and lightly dug in. A great many growers do not recognize the large amount of damage caused to the feeding-roots of citrus by deep digging and cultivation near the trees. The roots extend out as far as 3 ft. to 4 ft. beyond the spread of the tree. Shallow cultivation must be carried out, but it should be thorough and intelligent. The odour from damaged roots in the citrus-orchard is quickly detected, and one may soon know when working around the trees whether or not damage is being done. All the citrus family are naturally shallow-rooting trees, and should be treated accordingly.

PESTS AND DISEASES.

Among insect pests and fungoid diseases attacking citrus-trees the following may be considered to give the most trouble to growers in the Dominion: Insects—red scale (*Aspidiotus coccineus*), black scale (*Aspidiotus rossi*), brown or olive scale (*Lecanium oleae*), native scale (*Diaspis santali*), cottony cushion scale (*Icerya purchasi*), black aphis, thrip, and leaf-roller caterpillar. Fungoids—brown-rot, verrucosis, grey scab, and collar-rot.

Of the scales, the red scale may be considered the worst to deal with, but may be successfully combated by red-oil emulsion, as also may the black and native and cottony cushion scales and thrip. The black aphis may be controlled during summer by use of McDougall's insecticide at 1 in 50. The leaf-roller, which during the past few years has caused a considerable amount of damage on young trees, by eating off young shoots and flower-buds, should be dealt with by the use of arsenate of lead, up to 4 to 5–100, at intervals during spring and summer. Among fungoids, brown-rot is a disease which calls for special care in regard to combative treatment. Immediately upon the appearance of this disease the application of bordeaux is recommended, together with an application to the soil under the affected trees of sulphate of iron, 3 lb. to 4 lb. to each full-bearing tree.

Verrucosis is a form of cladosporium allied to fulvum of the tomato, and has proved a serious disease in our humid climate, which is very favourable to its development. Bordeaux is recommended as a preventive for this disease—three or four applications at intervals of ten to fourteen days, commencing immediately the bloom-petals have fallen. Remedial treatment is recommended as follows: Upon the first appear-

ance of the disease remove all infected fruit, cut away all dead wood, pick up old leaves and burn them all, and spray with bordeau at intervals. When advising the use of bordeaux as a fungicide on citrus-trees it is impossible to lay down any hard-and-fast rule as to the formula to be used at any stated time—firstly, owing to the bearing which climatic conditions and erratic seasons have upon the growth; and, secondly, owing in many cases to the extended and restricted season of growth often experienced consequent upon certain spray or manurial treatment which trees may or may not have received. When the trees are making young growth or blossoming heavily bordeaux, 3–4–40 or 4–4–40, may be applied. If young growth is well hardened and trees fairly dormant, bordeaux, 5–4–40, may be used.

For grey scab the treatment is similar to the foregoing.

It is probable that lime-sulphur may prove to be as effective as bordeaux in the control of fungoid diseases attacking citrus-trees. A series of comprehensive experiments are now being conducted with the compound in the Auckland district to test its value in this respect. So far the results are very encouraging, and a full report will be prepared for the *Journal* within a few months.

Collar-rot is one of the most serious diseases with which the grower has to contend. Liability to infection from the disease may be reduced to a minimum by the selection of well-drained soils and suitable stocks. If a tree becomes badly affected before the disease is identified and treated there is no cure: the tree should be removed and burned, and the hole from which it is dug well limed before planting another tree. If, however, the tree is only slightly affected on the collar the disease may be arrested and probably cured by the removal of the entire ruptured bark and gumming wood, and the application to the parts of crude carbolic acid and water, bulk for bulk.

While on the subject of spraying, I would point out that citrus-trees are naturally unable to withstand such strong solutions as would be applied to deciduous trees, hence the importance attaching to the vigilance of the grower in respect to regular spraying from the time the trees are planted out. Do not wait until fungoid troubles have made their appearance before spraying, but treat bordeaux or any other fungicide as a preventive rather than a cure. With insect troubles, if a sharp lookout is kept, the appearance of any troublesome insects noticed, and no time lost in taking the necessary steps to combat the pest, no great trouble need be anticipated in these days when we have such efficient insect remedies, both internal and external.

With regard to olive or brown scale (*Lecanium oleae*), this pest a few years ago threatened the citrus-groves round Whangarei. The steel-blue ladybird was introduced by the Department, and in three years the scale was almost entirely eradicated. Shortly afterwards growers in Poverty Bay encountered similar trouble with this scale, and consignments were sent to that district with the same result.

PRUNING.

Many growers are under the misapprehension that because citrus-trees are non-deciduous they do not need pruning. Thus they are allowed to grow at will, the result being an upright-growing tree, with a sprawling mass of weakly laterals, and with the centre choked up with a mass of still more weakly shoots.

If the best results are to be obtained, citrus-trees, like deciduous species, require building up from the start, and a system of pruning adopted to ensure continual and regular production of fruit-wood. Remove all side growths from young trees at planting, up to a height (if possible) of 12 in. to 15 in., retaining only three or four well-spaced branches or strong shoots. During the second and succeeding years maintain the leaders, keeping them out at a good angle, and encouraging meanwhile strong lateral growth. A well-shaped tree will thus be formed, capable of carrying a heavy crop without injury to limbs. Do not allow the laterals to become too long, but keep them shortened back to strong buds or sublaterals. Lower branches which are likely to hang to the ground or interfere with cultivation should be entirely removed.

When a tree reaches bearing-age the main work will be directed towards keeping the centre of the tree open, removing and preventing cross-branches, suppressing water-shoots and weakly growths, and maintaining sufficient lateral growths. In the lemon the fruit is mostly borne on the shoots occurring on laterals, on the terminals, or at the axils of the leaves; while with the orange there is frequently more fruit borne on the terminals of the laterals. Trees with open centres and well-spaced limbs, allowing for the free admission of light and air, ripen their wood well and are less susceptible to attacks from disease, and in the event of their becoming affected are much more easy to spray.

PICKING.

Citrus-fruits require to be cut from the tree—not pulled. This saves time at pruning, and the keeping-qualities are enhanced if a portion of the twig is left attached to the fruit. The lemon is often cut too ripe, and will then not keep for long in good condition. The fruit should be cut according to size and not to colour. Leaving the fruit until it is coloured tends to make it coarse and robs the tree unnecessarily, besides upsetting the prices.

HANDLING, CURING, AND MARKETING.

Handling of the crop, curing, and marketing are matters which would in themselves make rather a lengthy article. I propose, therefore, to deal with this branch of the subject in a future issue of the *Journal*.

VARIETIES FOR NOTE BY NEW ZEALAND GROWERS.

In lemons Lisbon (thorny) is the leading commercial variety, and will probably be the lemon inquired for if an export trade is initiated. It is a good grower, and a regular and constant cropper. Eureka (almost thornless) is a good variety, and the fruit is good quality. The tree is half dwarf in habit, and not such a good grower as Lisbon. Other varieties, in order of merit, are Villa Franca, Sicily, Messina, and Genoa.

In oranges the following varieties are giving the best results so far in New Zealand:—

Poor Man: Essentially a preserving-orange of high quality, a hardy and good grower and heavy cropper, coming into bearing at an early age.

St. Michael (common): This variety bears well in the North, is of medium size, of fair quality, and a good grower. It comes in at a good time for southern markets—if Island shipments are watched.

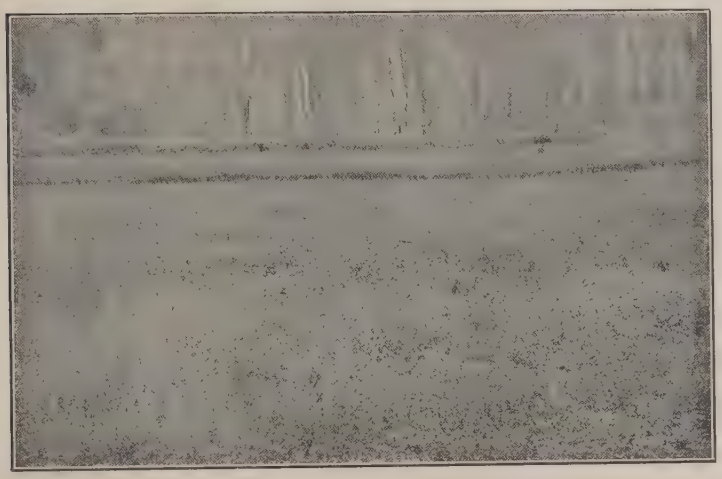
Washington Navel, Parramatta, and Mediterranean (sweet) are all good varieties, but none of these have been grown with great success in the Whangarei district. Jaffa is also worthy of notice.

A new seedling worked by an Avondale nurseryman—Best's Seedless—promises to become very popular. It is a good grower and bears fruit of excellent quality—an orange, in fact, that we have been looking for for a long while. This seedling has been described by leading citrus-growers and experts under whose notice it has been brought as an orange with a flavour and texture superior to that of any variety yet grown in or imported into New Zealand. Another local orange which promises well is now being worked by a Whangarei grower, who has assigned to it the name of Delicious. The fruit of this variety comes in at a good time, and hangs well over a long season.

LUCERNE-GROWING IN THE WESTPORT DISTRICT.

THE accompanying photograph of an area of lucerne grown on Messrs. Berry and Wilson's Waimarie Farm, north of Westport, was taken ten weeks from date of sowing. The lucerne shown in the background was sown in drills 21 in. apart, and is in the flowering stage, with a growth of 2 ft. 6 in. The lucerne in foreground was broadcast, and shows a growth of over 17 in. for seventeen days, having previously been cut and left as a mulch. This area, consisting of 1 acre, is situated near the mouth of the Mokihinui River. The land is a free loam with sand-and-gravel subsoil, and was originally in bush. The heavy timber was taken for milling purposes some twenty years ago, and the land used for grazing cattle, but it was never heavily stocked. In March, 1917, the land was stumped and cleared of logs, &c., then ploughed and sown in oats and tares, which were cut and fed to horses during the winter. In August, when there was a fair aftergrowth, sheep were put in and the oats and tares fed off. The area was then ploughed to a depth of 6 in. and limed at the rate of 2 tons of lime per acre, the lime being disked and harrowed in. Owing to the month of September and the greater part of October being exceptionally wet, even for this coast—the total rainfall for these months being 36 in.—no cultivation could be carried out until the last week in October, when two strokes of the harrows and disks were given. On 8th November the land was harrowed three times and rolled, a fine and firm seed-bed being established, and the seed then sown. Half an acre received inoculation at the rate of 350 lb. of inoculated soil per acre, the other half receiving no inoculation. As soon as the growth of lucerne would allow intercultivation was given between the rows of the drilled part.

Up to the time of writing (July) the whole area has done equally well, and two full cuttings and one light cutting have been taken off since the date of sowing to the first week of May. The lucerne is healthy in appearance and practically free from weeds. Judging by a small area sown in the Koiterangi district in January, 1917, there is yet



LUCERNE AREA ON WAIMARIE FARM (BUSH IN BACKGROUND).

ample time for the inoculation to prove if it is of value, as on that area it was not until the tenth month after sowing that any difference was noticeable between inoculation and no inoculation, after which the part without inoculation made poor progress in comparison with the inoculated part.—*C. S. Dalgliesh, Fields Inspector, Hokitika.*

MANUFACTURE OF DYES IN BRITAIN.

THE High Commissioner for New Zealand, in London, has been informed by the British Board of Trade that in the last two or three years considerable progress has been made in the manufacture of artificial dyestuffs in Britain, and it may be taken that, generally speaking, British manufacturers are now in a position to meet the demand both of the United Kingdom and the Dominions for about 75 per cent. of the dyestuffs which they are likely to require under normal conditions. The remaining 25 per cent. are largely dyes of a special character, the manufacture of which can only be undertaken as the necessary raw materials and technical skill become available. Up to the present the progress has been most marked with regard to those dyes required for the woollen industry, particularly those used for woollen-piece-goods dyeing, and there is therefore reasonable hope that it will shortly be possible to meet the whole of the requirements of the New Zealand woollen industry for dyes from British sources of supply. In this connection it may be stated that during the year 1917 licenses were granted for the export to New Zealand of 7⅛ tons of dyes.

USE OF STRYCHNINE FOR DESTRUCTION OF RABBITS.

CARROTS AND STRYCHNINE.

POISONING in this form is very effective in winter, when the carrots are fresh and crisp. If carrots are allowed to become soft and dry the rabbits do not eat them so well. The method adopted is as follows:

Cut up 15 lb. of carrots into small cubes, add 1 lb. of icing-sugar, and drain off any liquid after sugar has dissolved. Lay the sweetened cubes in light plough-furrows or scrapes, two cubes every 4 yards apart. Feed in this manner for three nights, and if the rabbits eat the carrots proceed as follows: Cut up 12 lb. of clean carrots into small cubes, add 1 lb. of icing-sugar, and allow carrots to drain until all surplus liquid runs off; grind 1 oz. of strychnine into fine powder, and sprinkle a teaspoonful at a time over the carrots until the ounce is all mixed, stirring well after each application of strychnine; then add 1 lb. of icing-sugar to cover taste of strychnine, and allow carrots to stand for two hours before laying. One poisoned cube every 3 yards is sufficient.

OATS, MOLASSES, AND STRYCHNINE.

This method has proved very effective, satisfactory kills having been made, and it can be used at any season of the year. It has been tried when there was plenty of feed, also when feed was scarce, and in both instances results were good. The method is as follows:—

Boil 15 lb. of oats (Garton's preferred) with 2 lb. of molasses or treacle, and sufficient water, until the oats are soft, draining off any surplus liquid. The oats are then ready to lay for feeding purposes. Run light plough-furrows about 2 chains apart on the land where rabbits feed principally at night, and lay baits of a dessert-spoonful every 4 yards apart in the furrows. In country too rough for the plough lay the baits in scrapes or spade chips. Continue this for three nights, and if the rabbits are then eating the sweetened oats well, proceed with the poison as follows: Weigh out 24 lb. of boiled oats treated as before mentioned; pour into a wide bath or tub; grind 1 oz. of strychnine to fine powder, and sprinkle a teaspoonful at a time over the oats, stirring well after each sprinkling until the strychnine is all mixed; after which add 2 lb. of sugar to give a sweet coating, as, the rabbits having been fed on sweetened oats, it is advisable to cover the taste of the strychnine. Allow the oats to stand for two hours before laying. In laying the poisoned oats, one teaspoonful is sufficient every 4 or 5 yards. The same furrows as were used for feeding purposes will do for the poison.

POINTS TO OBSERVE.

Special care should be taken that all utensils used in the preparation of the poison are perfectly cleaned. The strychnine should be ground as fine as possible, no grittiness to be observable.

NOTE.—The foregoing matter has also been published as Bulletin No. 76.

SEED-TESTING NOTES.

By E. BRUCE LEVY, Biological Laboratory.

"CHEAP" MIXTURES.

THE farmer who has poor rough country unsuitable for the immediate establishment of even fairly good grass-land must adopt a cheap seeding practice, the productive earning-power of such land making it often economically unsound to apply expensive mixtures. A cheap seeding, however, does not imply that the seed used should be a cheap grade of any particular seed, but that the amount of money spent per acre should be low. Just what constitutes cheap seed is a question that should demand the close attention of every farmer, especially of those who are farming on rough country where economy demands cheapness of seeding.

Cheapness of seeding can be secured (*a*) by limiting the amount sown; (*b*) by sowing seed of inexpensive varieties; (*c*) by sowing "cheap" seed—generally mixtures at so-much per pound. The third method is frequently adopted on the mere statement that the mixture represents a value far in excess of the price demanded; but selection of such mixtures demands great judgment on the part of the farmer to ensure that they really are cheap.

In the accompanying set-out analysis of a typical "cheap" mixture in demand for rough county (Fig. 1) it will be seen that the real value of such a mixture is approximately 4¾d. per pound, and unless a farmer can buy such a mixture for considerably less than 4¾d. he cannot in any way congratulate himself on his deal. It is true he will not get even a pound of, say, rye-grass for 4¾d., but he will get more living plants in 4¾d. worth of a good viable clean seed, and it is the living, desirable plant that the farmer requires and which he pays to get.

Judging from prices quoted for similar mixtures, I should say that the price asked for the one in question would be not less than 6½d. per pound, which would be the ordinary market value of the seed, provided the mixture were 100 per cent. purity and each constituent 90 per cent. germination. In these estimations the 4 per cent. of other seeds has not been taken into consideration, as there was but a trace of the more useful, the greater portion being Yorkshire fog. Many of the seeds were mere kernels. It will be noted that the mixture contains virtually no cocksfoot, an essential ingredient for nearly all rough country.

The "clover-mixture" sample illustrated in Fig. 2 is a further example of expensive "cheap" seed. This line was offered as "great value," price 10d. per pound. The following is my analysis: 30 per cent. suckling-clover (germination 92 per cent.); 29 per cent. white clover (germination 42 per cent.); 19 per cent. red clover (germination 50 per cent.); 20 per cent. weeds, dirt, &c.; 1 per cent. other clovers—Alsike, lucerne, English trefoil, and clustered clover; 1 per cent. other useful

Typical 'Cheap' Mixture in Demand for Rough Country

Analysis - Dissection of 5 grams of mixture -

		Value of each seed in 100lb of mixture
Weed seeds 5%		
Yorkshire Fog, Crested Dogstail, Cocksfoot, Poa pratensis, Chewings fescue	Alsike, English Trefoil, Lucerne, Lotus hispidus — 4%	
White Clover 5% Germination 56%		@ 2/ per lb. 6/3
Red Clover 6% Germination 43%		@ 1/9 per lb 5/-
Suckling Clover 15% Germination 91%		@ 6° per lb 7/7
Italian Ryegrass 8% Germination 85%		@ 5° per lb 3/2
Perennial Ryegrass 56% Germination 68%		@ 5° per lb 17/8
		39/8
		approx 4% per lb real value on basis 90 per cent Germination and 100 per cent Purity

Mixture comprised of seeds of 65 species of plants

Weed seeds present :-

Ribgrass (Plantago lanceolata)
Sorrel (Rumex acetosella)
Catchfly (Silene anglica)
Curled Dock (Rumex crespus)
Scarlet Pimpernel (Anagallis arvensis)
Hairgrass (Festuca bromoides)
Spurrey (Spergula arvensis)
Sedge Mustard (Sisymbrium officinale)
Narrow-leaved Cress (Lepidium ruderale)
Cat's ear (Hypochaeris radicata)
Wireweed (Polygonum aviculare)
Soft Brome Grass (Bromus hordeaceus)
Mouse-ear Chickweed (Cerastium vulgatum)
Hawkweed (Crepis capillaris)
Hawkbit (Leontodon hirtus)
Sweet Vernal (Anthoxanthum odoratum)
Clustered Clover (Trifolium glomeratum)
Turnip (Brassica sp)
Small Canary Grass (Phalaris minor)
Fathen (Chenopodium album)
Dandelion (Taraxacum officinale)
King Island Melilot (Melilotus arvensis)
Greater Plantain (Plantago major)
Sow Thistle sp.
American Cress (Barbarea praecox)
Ditchwort (Stellaria graminea)
Orache (Atriplex patula)
Field Madder (Sherardia arvensis)
Golden Hellot (Schaeria glauca)
Rush (Juncus sp.)
Chickweed (Stellaria media)
Bladder Campion (Silene inflata)
Spotted Burr Clover (Medicago maculata)
Small flowered Cranesbill (Geranium pusillum)
Wild Carrot (Daucus carota)
Small flowered Buttercup (Ranunculus parviflorus)
Broad Dock (Rumex obtusifolius)
Annual Meadow Grass (Poa annua)
Prickly Sowthistle (Sonchus asper)
Hogweed (Senecio sp.)
Californian Thistle (Cnicus arvensis)
Knee jointed Foxtail (Alopecurus geniculatus)
Dodder (Cuscuta Trifolii)
Forget me not (Myosotis arvensis)
Thompson's Bent Grass (Triodia Thompsoni)
Small flowered Mallow (Malva parviflora)
Smartweed (Polygonum Persicaria)
Green Pigeon Grass (Setaria viridis)
Hairy Buttercup (Ranunculus sardous)

also noted :-

Wheat (Triticum sativum)
Linseed (Linum usitatissimum)
Ergot (Claviceps purpurea) & fungus sclerotium

FIG. 1.

[Glass tube on left contains percentages by weight of the various seeds according to analysis.]

[*Diagram by E. Bruce Levy.*]

"CHEAP" SEED.

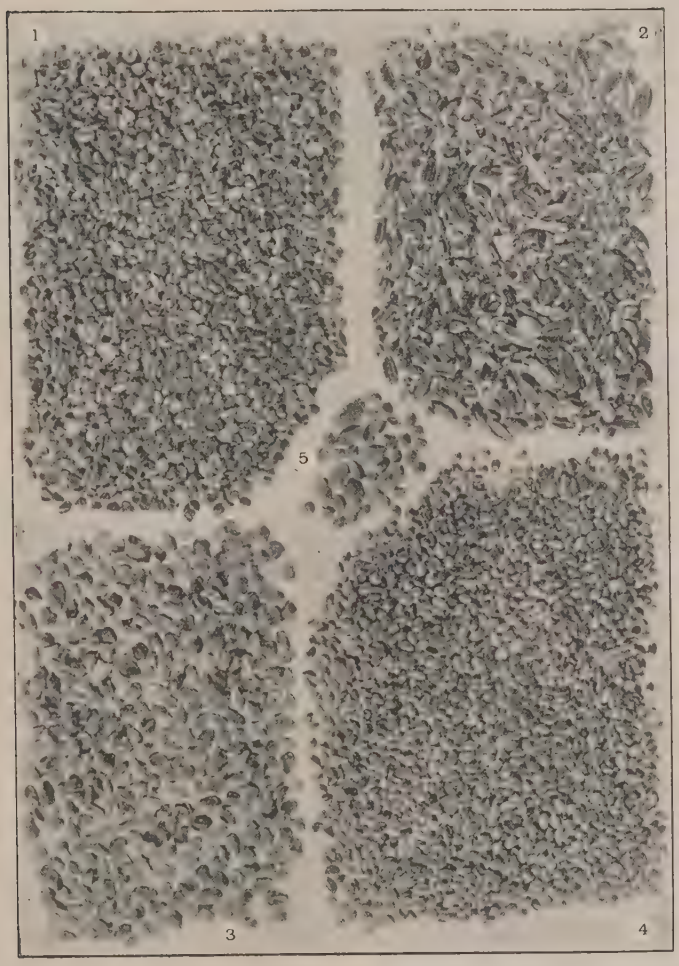


FIG. 2. DISSECTION OF 2½ GRAMS OF "CLOVER-MIXTURE" SAMPLE.

(1) White clover; (2) weeds; (3) red clover; (4) suckling-clover; (5) other clovers.

[E. Bruce Levy, photo.

extraneous seeds—perennial rye-grass, cocksfoot, timothy, Yorkshire fog, and crested dogstail.

The following weed-seeds were noted : Rib-grass, sorrel, curled dock, mouse-eared chickweed, catchfly, scarlet pimpernel, catsear, American cress, fat-hen, forget-me-not, wireweed, spear-thistle, spurrey, chickweed, stitchwort, field-chamomile, ergot, chicory, broad-leaved dock, wild carrot, greater plantain, field-madder, goose-grass, green pigeon-grass, hawkweed, *Poa annua*, black nightshade, sweet vernal, small-flowered cranesbill, *Salvia* sp., and one seed I am unable to name.

The real value of this line on the basis of 100 per cent. purity and 90 per cent. germination is approximately 7¼d. per pound. At 10d. per pound, therefore, the seed is highly expensive, and even if it could be bought at less than 7¼d. no farmer who takes a pride in his farming or who is businesslike in method would consider such seed for a moment. That such seed is sown, however, is evidenced by the number of samples received by this Laboratory for testing, and by the stock samples of certain merchants.

Examples such as the foregoing indicate a pressing need in New Zealand for legislation regarding the sale of seeds, such as has now been adopted in the majority of progressive agricultural countries.

METHODS OF TURNIP-SEED PRODUCTION IN EUROPE.

By A. H. COCKAYNE, Biologist.

CORRESPONDENCE received by the writer since the publication of the article, "Turnip- and Rape-seed Production," in the June issue of the *Journal*, indicates that a good deal of misconception has arisen as to the various methods that are adopted in turnip-seed production in Europe, and it will be well to give an outline of these. There are four main methods, as follows :—

(1.) *Mother-seed Production.*—This represents the most important phase of turnip-seed production wherever the industry is a permanent one. It consists of the most careful physical and chemical analysis, combined with careful attention to size, shape, and vigour of the bulbs selected for transplantation. Special methods of storage and transplanting are carried out, and in many cases field-growth tests are carried out before the seed is used for general field-seed production. Such mother-seed represents the stock seed that is supplied to farmers who undertake contract growing. In certain cases, especially with varieties that appear to be very well fixed, such as Green-top and Purple-top Aberdeen and Devon Greystone, an exceptionally good crop may be carefully gone over and poorly shaped bulbs removed, and without any transplanting a seed crop is produced which is used as mother or

stock seed. This, however, is not usual, transplantation of specially selected bulbs being the rule. The production of special stock seed is very largely under the control and guidance of the main turnip-seed houses, but occasionally a farmer may be both the selector and the grower of his seed. The production of special stock seed is in every case an essential when turnip-seed-growing becomes a permanent feature.

(2.) *Transplanting of Good Average Bulbs.*—This method, although common in Europe and Great Britain, is carried out on a large scale only with regard to swedes. The farmer selects what appears to him to be good typical bulbs, and they are stored and planted either in the late autumn or early spring. Very often the tap-root is cut off, the reason apparently being the idea that such procedure stimulates flowering. The bulbs are invariably planted right up to the neck, so as to avoid any rotting by dry-rot fungus. The selection of bulbs for mother-seed production is generally supervised by a representative of the firm who makes the contract, and this is more particularly so when the firm specializes in some special variety, such as Superlative, Magnum Bonum, and Monarch.

(3.) *Holding over Crops.*—This has become a very regular method in producing turnip-seed—partly on the contract system and partly for the open market. The crops are grown with special stock seed, and a certain amount of moulding-up may occur in districts where the winters are severe. In Europe in 1916 and 1917 many of these held-over crops were destroyed in the winter, and this largely accounts for the shortage in certain varieties, such as Aberdeens and Green Globes, that are largely grown for seed in this manner.

(4.) *Thick Autumn Sowing.*—With thick late summer and autumn sowing special stock seed is always used, and from 4 lb. to 8 lb. of seed per acre may be used, either drilled or broadcasted. This is the regular method now adopted for all soft-fleshed turnips, and also to a large extent for swede-seed production. The idea is to avoid any danger of bulb-rotting, as very little bulbing is allowed to occur. It is said that seed grown in this manner is more liable to deteriorate in vegetative growth than when held over or when transplanting takes place, and that a continuous production of fresh stock seed from season to season is required.

Mr. G. J. Black, who has 40 acres of lucerne on his Pakowhai farm, near Gisborne, writes: "I have found it hard to keep the lucerne-paddock here clean, the grass and clovers getting a big hold after a couple of years. But the amount of feed we get is wonderful; I have had as many as thirty sheep to the acre on the paddock for weeks at a time."

Keeping birds that have passed their stage of usefulness is one of the chief weaknesses of farm poultry-keeping.

The poultry show, judged on a proper standard, is the only means of checking deterioration in breed character.—*F. C. B.*

WORK FOR THE COMING MONTH.

THE ORCHARD.

ORCHARD troubles for which spraying is necessary include insect pests and fungus diseases. The former are divided into two groups—chewing and sucking. The main ill result from sucking-insects is to the tree itself. The vitality of the tree becomes affected through the loss of sap in accordance with the severity of the attack, and it is in this way that the fruit crop suffers, particularly so if the trouble is of long standing, in which case the tree, if not permanently injured, may take some time before adverting to a normal state of health and vigour even after the cause has been removed.

On the other hand, chewing-insects affect the fruit crop more directly, as in the case of codlin-moth infection, or through the defoliation of the tree, as in the case of pear-slug. Destructive as either of these groups may be, however, they present no insurmountable difficulties to the experienced fruitgrower; their treatment is mainly straight-ahead work. His main effort is to select the most efficient and economic of the many spraying formulæ now in use, and, having done so, to apply them at the correct time and in a thorough manner. Climatic conditions may at times interfere with this work and render it difficult, but rarely to the extent of making it altogether impossible.

The fungoid group, however, present an entirely different proposition. The saleable portion of the fruit crop is annually reduced to a considerably greater extent by one member or another of this group, either directly or through damage to foliage, than by any other cause. Their attacks are more subtle and tax the ingenuity of the orchardist to a very much greater extent. No spraying can be relied upon to cover a given period to the same extent as with insect pests. Wet weather, although it may retard spraying operations, has the effect of checking to some extent the activities of insect pests, but it has quite the contrary effect on fungus diseases, and such weather may intervene and upset the whole spraying programme. Again, the line between the degree of spraying that the foliage and fruit will withstand, and that required to destroy the disease, is so finely drawn as to be almost non-existent with some varieties under adverse conditions, and damage from one cause or the other is likely to result. Bordeaux mixture is the most reliable fungicide we have, but, in the interests of the fruit and foliage of many varieties of apples and certain stone-fruits, commercial or self-boiled lime-sulphur must be substituted. The lower fungicidal property of lime-sulphur, however, often results in its failure to satisfactorily control the disease. When such does happen it is better for the grower, at least in the case of apple-scab, to resort to bordeaux, on the principle of its being preferable to have russety fruit rather than scabby fruit.

However, the object should be to reduce the possibility of fungus troubles to a minimum by attending to the various matters of cleanliness in the orchard, cultivation, &c., discussed in previously published advice, and also by thorough spraying two or three times at frequent intervals, from the time the tree begins active growth onward. With pip-fruits the work should be carried out from the cluster-bud period to well after the fruit has set. The earlier spraying at this stage can be made with stronger mixtures, thus taking an opportunity to destroy the spores before they become established for the new season. With many varieties of apples and pears that time is now. The local advice by the Orchard Instructors for the various main districts, which follows, will serve as a guide in many points of detail. As regards Otago, Mr. J. H. Thorpe has now been appointed to this district, in Mr. Goodwin's absence, and local notes will appear as from next month's issue.—*J. A. Campbell, Assistant Director of the Horticulture Division.*

AUCKLAND.

Control of brown-rot: Growers of stone-fruits are specially directed to give full attention to maintaining their sprayings for control of brown-rot. The bordeaux colour-bud spray (8–6–40) applied last month will be followed by either bordeaux, 2–3–50, or lime-sulphur, 1–120, when three-fourths of blossom petals have fallen, again when fruit has set, and again one month later. Self-boiled lime-sulphur may be used as a summer spray for stone-fruits. Directions for preparation were given in the July *Journal*.

Fungoid diseases attacking pip-fruits: The failure to carry out efficient sprayings, especially in the case of pears, has spelled little short of disaster to some growers during the last two seasons, hence the very urgent necessity of attention to details in this regard. Growers are advised in the case of pears to put on their first summer bordeaux, 3–4–40, plus arsenate of lead, as soon as the fruit has set, and to continue with the same formula, or lime-sulphur, 1–80, as required. Bordeaux and subsequent summer sprays as for pears may be used on the hardier varieties of apples, but the strength should be reduced to 2–3–40, or lime-sulphur, 1–100 to 1–120, substituted in the case of those varieties liable to spray-scorching.

Those growers who intend making up their own lime-sulphur may obtain Bulletin No. 63, which gives full particulars, from the local Orchard Instructor.

Codlin-moth, leaf-roller, &c.: As the blossom petals fall from the newly formed fruits the first arsenate-of-lead spray should be applied, combined when necessary with bordeaux or lime-sulphur. A high-pressure pump is here very necessary in order to ensure that the calyx of the embryo fruits may be filled with the poison as well as the entire surface covered.

Citrus-fruits: Growers are directed to make a careful examination of their trees as soon as possible, and cut away all wood that may have been affected by the severe frosts experienced in the north during July and August. Failure to remove these parts invites attack from borer, and may result in infection from die-back or wither-tip. Cross-branches and growths choking up the centre of the trees, if not already removed, may be taken out at the same time. Lemon and orange trees suffering from attack by scale, thrip, &c., may be sprayed early in the month with red oil (1–40) if sufficiently dormant. On the other hand, if heavy young growth has commenced the spray must be broken down to about 1–45. In cases where bordeaux also is to be applied for fungoid troubles the oil should follow the bordeaux (4–4–40).

Strawberry-culture: Growers are advised to keep their plants growing by continual cultivation, and maintain sprayings with bordeaux, 4–4–40, for leaf-spot.

Spraying summary: Spraying recommended for the month (October) may be summarized as follows:—

Peach, nectarine, and plum: When fruit has set, and again one month later —commercial lime-sulphur, 1–120, or bordeaux, 2–3–50.

Pear, apple, and quince: When fruit has set—bordeaux, 3–4–40; three weeks later—bordeaux, 3–4–40, or lime-sulphur, 1–80 to 1–100, in combination with arsenate-of-lead paste, 1½ lb., or powder, ¾ lb., to 50 gallons water, when the petals fall.

Lime-sulphur, 1–100 to 1–120, should be substituted for bordeaux, or the strength of the latter reduced to 2–3–40, when spraying Jonathan, Adams Pearmain, Cox's, and other varieties liable to spray-damage.

Lemon and orange: When trees are practically dormant, or have only a slight show of young growth—bordeaux, 4–4–40, followed by red oil, 1–40.

General: Manuring, ploughing, and digging should be pushed on where this work is behindhand. Wet days may be profitably spent in making up fruit-cases. —*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

Peaches: Many of these fruits will be set by the end of September. Lime-sulphur, 1–125, could be applied at this stage as a precautionary measure against brown-rot.

Plums: Most of the Japanese varieties will be in full bloom, but many of the choice English kinds will be more or less dormant. On these do not omit 6–4–50 bordeaux in cluster-bud as a preventive against rust, this being important.

Up to the present it must be recognized that all efforts for the control of brown-rot have been more or less experimental. From observations made last year I am inclined to the opinion that insects and grubs are serious factors in the spread of this disease. On this assumption I would suggest that a limited trial at least be given to the following course of treatment for plums: Spray with lime-sulphur, 1–30, combined with arsenate of lead, 1½ lb. paste to 50 gallons water. The addition of lime to the arsenate will make the spray less caustic. Spray as soon as the fruit is well set, and repeat at intervals of four to five weeks. I realize that there is a risk in applying this combined spray to peaches, but it should be given a good trial on plums. It will be tried in a small way in the local brown-rot experimental peach-orchards.

Apples: Many varieties should be in cluster-bud at the end of September. Dougherty, Stone-pippins, and varieties subject to black-spot should be sprayed at this stage with 6–4–50 bordeaux, to be repeated when the fruit has set at 3–4–50. Other varieties could be sprayed with lime-sulphur, 1–25 to 1–30, or atomic sulphur, 10 lb. to 12 lb. to 100 gallons. This treatment is essential for successful mildew-control. Follow with lime-sulphur, 1–100, when the fruit has set. Do not omit one of these cluster-bud sprays, remembering that bordeaux is the better fungicide for black-spot.

Pears: Many of these fruits will be in full bloom. For black-spot spray with bordeaux, 3–4–40, when the fruit has set, and if the weather is damp repeat at short intervals. Lime-sulphur, 1–80, could be substituted when spot is not troublesome.

Codlin-moth: Attend to the calyx-spray on apples. Spray when the majority of petals have fallen, or, if possible, a little earlier, and spray twice. One spray on pears will suffice when the fruit is well set; the calyx keeps open much longer than on apples. Use arsenate-of-lead paste, 1¼ lb. (or powder, ¾ lb.) to 50 gallons water.

Lime-sulphur: The necessity of having the specific gravity of this compound tested is not always realized. It possibly means the difference between success and failure, particularly where scorching of foliage takes place. It is important that each individual barrel be tested. Recently I met with a variation of 3 degrees in two barrels of the same brand. The whole should be well shaken when a sample is taken for testing; this also applies when running off material for spraying; the bottom of the barrel is likely to be of heavier density than the top. Samples left with Mr. Rodda, Manager of the Arataki Horticultural Station, or Mr. Morris, Agricultural Instructor, Hastings High School, will be tested free of charge. All growers should avail themselves of this offer, and then dilute according to the scale supplied in Bulletin No. 63.

General: Ploughing the pip-fruit section should be pushed on with all speed and completed as early as possible. Grafting of unsuitable varieties of pears and apples can now be done with advantage.—*G. Esam, Orchard Instructor, Hastings.*

NELSON.

Spraying: This operation is still the most important one in the orchard. Many pear and apple trees will commence to open their flower-buds early in the month. This stage in their growth is the period when the most important application of fungus-spray is made on bearing trees. Lime-sulphur, 32° Baume, 1–30, may be applied to these trees without injury under normal conditions, but the usual local practice is to apply it at a strength of 1–50 or even 1–60. Trees weakened by overcropping should receive the weaker mixture. Where bordeaux is necessary in preference to lime-sulphur, the summer formula, 3–4–40, has given very good results. All bearing pip-fruit trees should receive one or the other of the sprays mentioned. During the month plum, peach, and nectarine trees will have set their fruit, and in view of our experience with brown-rot last season it is desirable at this stage to make another application of fungus-spray. It must be remembered that the foliage of these trees is tender. Every care should be taken in mixing the spray, and dull weather chosen, if possible, for applying it. Present experience indicates lime-sulphur, 32° Baume, 1–125, or bordeaux, 2–3–40, as the best spray for this purpose.

Cultivation: Where a growth of weeds or cover-crop has been turned in during the spring it is undesirable to disturb it until it is thoroughly decayed. Nevertheless, a free tilth should be maintained in the orchard at this period. On the heavier land, towards the end of the month, a thorough harrowing with the disks will be beneficial in many cases. A word of warning is necessary under this heading. To work most of our Nelson lands when wet is most disastrous, but unfortunately this has been too often done and the mechanical condition of the soil ruined for a long period. Should the weather be bad it is better to let the weeds grow than work the land with implements while it is wet.

Grafting: The season is still suitable for regrafting fruit-trees.—*W. C. Hyde, Orchard Instructor, Nelson.*

CANTERBURY.

Any grafting, such as the reworking of old trees, that has not already been attended to should be pushed on with at once. Every precaution should be taken at this time of the year to see that all accumulations of rubbish, such as prunings from shelter-belts or fruit-trees, are disposed of. Any mummified fruit, rough bark, and dead shoots should also be removed from trees, and thorough and clean cultivation should be the order of the day. This will greatly facilitate the control of orchard pests during the summer.

The first (calyx) spraying for codlin-moth with arsenate of lead will take place towards the end of the month. To get the best results high pressure is necessary to force the spray into the eye of the apple. As apples spread their blossomings over several weeks, spraying should not be delayed till all blooms have fallen, otherwise more than half would probably be past the stage when the poison can be got into the calyx-basin. Arsenate of lead should be continued with at intervals of twenty days. As fungus diseases are now most likely to be troublesome, a combined fungicide and insecticide may be used, serving a dual purpose.

Spraying for the prevention and control of the various fungoids, especially black-spot, will have already commenced, and should be continued. Powdery mildew is likely to appear as soon as growth commences, and if left to go unchecked will have very disastrous effects on some of the weaker varieties of apple-trees, such as Jonathan. All diseased wood should be taken out in the winter pruning. The trees should be sprayed with lime-sulphur as soon as the buds burst, and any growth showing disease pinched out.

Stone-fruits are liable to be attacked by black-aphis at any time during the spring. It is advisable to watch carefully, and on the first appearance of any aphides spray with Vistolene, kerosene emulsion, or any other suitable wash. Do not wait until these insects become numerous, or great difficulty will then be found in controlling them, as the leaf curls and folds over, making it almost impossible to touch them with the spray. Usually the best results are obtained by dealing with them early, and spraying twice in succession.—*W. J. Courtier, Orchard Instructor, Christchurch.*

POULTRY-KEEPING.

By F. C. BROWN, Chief Poultry Instructor.

IT should be unnecessary to emphasize that if vigorous and profitable stock is to be reared the full complement of chicks must be placed in the brooder or be hatched out in the natural way by the end of October at the latest. The margin of profit to be made from late-hatched stock is low, even in normal times, but with the high cost of foodstuffs facing the poultry-keeper at the present time they may easily mean a loss instead of a gain. The objective of all who keep poultry should be to secure eggs in the dear season of the year. This cannot be attained with late-hatched birds. Usually they only commence to lay in the spring, when eggs are cheap, while in most cases their product is small and of inferior market quality. Another drawback of late-hatched stock is that they seldom grow to a desired size, and are always more prone to disease than chicks brought out at the right time.

DUCK-REARING.

While it is now too late to hatch ducks for the Christmas table trade, October is a good time for hatching birds of a laying-type. Owing to the rapid way in which ducks develop they may be hatched to advantage much later than chickens. Indian Runner ducks hatched now may be expected to lay about April next. From an egg-producing viewpoint this breed of duck is extremely profitable if properly managed. Especially does this apply where a good range is available, as they are great foragers and will themselves secure a great part of their living. Ducks are heavy feeders, but they will thrive and do well on a much cheaper food than is the case with poultry. Hard grains should not be fed to ducks; better results are obtained by feeding mash entirely. Breeding-ducks should not be forced for egg-production, as this is a common cause of infertile eggs and weakly stock being produced. Two parts of pollard, one part bran, a half-part maize-meal, 5 per cent. meat-meal, with 25 per cent. of finely chopped lucerne, clover, &c., added, makes a suitable ration for breeding-birds. When ducks have an unlimited range over grass-paddocks or swamps they will pick up a great part of the animal and green food they require. Therefore the quantity of these materials to include in a mash must be varied in accordance with the range given to the birds.

Owing to ducks dropping their eggs anywhere, they should be enclosed in a run during the night. A wire-netting fence 2 ft. high will serve for this purpose. If the birds are kept in until about 10 a.m. all eggs will usually be laid by this time. Ducks are creatures of habit, and when allowed a free range, if fed at a regular hour in the evening, they will come home and can be locked up for the night. Ducks should be always fed in troughs, otherwise much of the food will be wasted.

In mating Indian Runner ducks one drake is usually allowed to six females. Ducks are easy to hatch and rear by artificial means. The temperature during the period of incubation, at the level of the tops of the eggs on the tray, should be 102° F. for the first week; from this on to the pipping stage 103°; and 104° to 105° when hatching. If the right degree of heat is maintained in the incubator and the eggs are

fairly fresh when set, the ducklings will commence to pip on the twenty-sixth day and hatch out on the twenty-eighth. Never open the incubator and attempt to help the young birds out of the shell unless they have been given their full time to hatch. During the early stages the eggs require very little cooling. After the third day they should be turned, both morning and night. Usually the time it takes to do this is all the cooling they require for the first week. In the second and third weeks the time of cooling should be extended by degrees up to twenty minutes or even half an hour, while during the last week, if the weather is favourable, they may be left out much longer. After being set for four or five days the eggs should be tested and the infertile ones taken out. Sometimes a germ dies after making a healthy start, and the egg rapidly decays. Frequent tests should be made to detect such eggs, and they should be removed promptly from the incubator, as they give off a bad odour which is apt to injure the hatching-qualities of the remaining eggs in the machine. Usually the shell of a decaying duck-egg becomes discoloured, and can be readily detected by a man of experience without the use of a tester. Duck-eggs require much more moisture than hen-eggs; the best system of applying this is to spray water at a temperature of 103° (with the mouth will do) on the eggs every morning after the fourteenth day. Do this after turning, and immediately place the eggs back in the machine. It is a mistake to cool after spraying. Spray in the morning and cool at night. The ventilation-vents should be partly open, so that any excess of moisture not required by the eggs can get away.

Ducklings are much easier to rear by artificial means than chickens. For this purpose the fireless brooder, as described and illustrated in the Department's Bulletin No. 66, "Utility-poultry Keeping," is strongly recommended. In this apparatus provision is made for an ample supply of fresh air, which is the keynote to success in brooding ducklings. Indeed, half the mortality that takes place among ducklings during the brooder stage can be put down to failure to observe this great essential. Placing young ducklings in a badly ventilated brooder is a common cause of staggers. Birds thus attacked give every indication of being affected with sunstroke; they usually stagger, fall on their backs with their eyes twitching, and present a generally distressed appearance. As is the case with chickens, ducklings should not be fed for thirty-six hours after hatching. In the first week the food may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, and with 5 per cent. of fine grit added. Feed four times a day a quantity that the birds will pick up clean in about ten minutes. When the ducklings are about a week old the grit need not be mixed with the food, but it should always be available to them in a receptacle so that they can help themselves.

Finely cut green food, such as lettuce, young tender grass, &c., should be fed separately after the first week. After ten days a little boiled mince-meat should be given, and increased by degrees as the ducklings develop. As they grow older feed equal parts of maize-meal, pollard, and bran. It will generally be found best to moisten the mash with hot water until the birds are about two weeks old. Water should be given with the first meal, and from then onwards it should always be left in reach of the birds, both day and night. A common cause of mortality in ducklings is confining them by night in the brooder

without water and giving them a heavy drink before receiving their morning meal. Where ducklings are provided with water after a long fast they mostly drink to excess, with very fatal results. The drinking-vessels should be sufficiently deep so that the birds can wash off any food that may adhere around their nostrils, and at the same time give them a good blow-out. Once the nostrils are allowed to clog, the eyes become plastered, while lameness and other troubles are apt to set in.

Young ducks are very prone to sunstroke, and if not provided with good shade during hot weather the mortality will be high. Ducklings should be well protected from their natural enemies, such as rats and stoats, until they are about three-parts grown, otherwise they are apt to be killed by these pests.

FIRELESS-BROODER IMPROVEMENTS.

Some slight but desirable improvements have been made to the circular hover of the fireless brooder recommended in the *Journal* for September, 1916, also in Bulletin No. 66. The chief improvement made is that instead of the piece of blanket being fixed on the top of the circular frame, with a sag in the centre, it is now placed on the underside and stretched as taut as possible. Experience has proved that by arranging the blanket in this manner the chicks are induced to spread better over the floor of the brooder. The hover is placed sufficiently low to enable the chicks to touch the blanket with their backs at all its parts, without having to stand up to do so. The two curtains are fixed to the frame in the usual way.

Another alteration made is that in place of having a piece of cardboard or similar material round the hover to prevent the chicks from being pushed out from under it when young, ½-in.-mesh wire netting is now used. This is made circular, about the same size as the hover-frame, and some 4 in. high. It is placed on the bedding-material, under the hover, the curtains being allowed to hang on the outside of it. In order to keep this wire-netting hoop in a firm position a piece of plain wire of, say, No. 10 gauge is threaded through the meshes at both top and bottom. This arrangement not only effectively keeps the chicks under the hover, but at the same time allows the admittance of an ample supply of fresh air, which is so essential to their welfare. Another advantage is that it keeps the bedding-material, such as cavings, pine-needles, &c., from being worked out from under the chicks. When the birds grow older and have acquired the habit of remaining under the hover the wire-netting hoop can be placed on the top of the latter. This will prevent the chicks from flying on to the hover and soiling the blanket.

In place of having three adjustable legs fixed to the hover-frame, three pieces of thin chain are now used. These are fastened through small holes on the top of the frame, and, with corresponding hooks or bent nails in the sides of the brooder-box, the hover can be raised or lowered with little trouble in accordance with weather conditions and the size of the chicks.

In using this hover it is of vital importance that nothing but pure all-wool blanket (New Zealand manufacture for preference) should be used for the top and for the curtains. Cases have recently come under my notice when this style of brooder has not been worked to the best advantage, for the reason that the material used was too thick, or too

closely woven to admit the necessary fresh air to the chicks. For instance, on one plant where I was called in to advise as to the mortality in chickens, felt, such as that used for lining horse-covers, was being used. Naturally this material confined the air and transpiration to such an extent that both the chicks and their quarters got into a wet and unhealthy condition. This meant that immediately the little birds were allowed out of the brooder they became chilled—the cause of most chicken troubles. During the coldest season of the year an open but fairly thick quality of blanket is necessary to ensure best results. In the summer, however—especially in the North Island—when hot weather conditions prevail, a thin quality of blanket or flannel is recommended. In fact, if the weather is very warm and the chicks are about three weeks old, a piece of sacking or even scrim may be used to advantage. It cannot be emphasized too strongly that dampness should never be allowed to exist under the hover, or trouble is sure to follow.

THE APIARY.

By E. A. EARP, Apiary Instructor.

FEEDING AND WATER.

A CONSTANT watch should be kept on the stores in the hives. Usually at this period there is a steady drain on the food-supply to meet the incessant demand for brood-rearing. If an examination of the hives was carried out as advised in my July and August notes, then the losses attendant upon spring starvation will have been avoided; but it is not wise to neglect to feed where stores are short, as the spring is the most critical period for the beekeeper. The weather conditions are not always favourable for the bees to work the early spring blossoms, and in populous colonies the food-supply should be augmented—but only where there is a noticeable shortage. If there is a good queen in the hive she will usually begin laying as fast as weather conditions will permit, and it is a mistake to start feeding unless stores are very short, as it stimulates brood-rearing, and when started must be carried on until a natural flow sets in from the fields.

Abundance of stores is certainly required at this season, and if the beekeeper finds that additional food is required it can be supplied in the form of combs of honey or as a syrup. The feeding of combs of honey should not be practised unless the beekeeper is sure that his apiary is free from disease, as there is always danger of spreading disease by this method. No better substitute for honey has been found than cane-sugar, and it is far safer to use it at all times if the beekeeper is not satisfied as to the health condition of his apiary. Honey from an unknown source should never be fed. There are many feeders on the market. The division-board feeder is the best to use at this season, as it will serve the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive.

In the spring months, when brood-rearing is at its height, bees require a good supply of clean water in the apiary. If this is not

provided they are apt to become a source of annoyance at drinking-troughs and by congregating round domestic supplies. Brood requires a great deal of water in addition to pollen and honey. The amount depends largely on how much brood-rearing is going on, and to what extent nectar is coming in from the fields. If water is not close at hand many bees are lost in trying to obtain it, more especially as the weather is often changeable and boisterous in the spring.

Many simple contrivances can be made to supply water. "Simplicity" feeders make excellent vessels for the purpose, but they require to be filled frequently. To start the bees taking water from any particular place it is a good plan to slightly sweeten the first water given.

DISEASE.

At all times when examining the combs keep a strict watch for symptoms of disease. Beekeepers should never lose an opportunity of acquainting themselves with foul-brood in all its stages. At this season if isolated capped cells are discovered in frames which contain no other brood, these should be treated as suspect and subjected to the test for foul-brood. If on opening a cell, when a sharp-pointed piece of stick is inserted, the dead imago can be lifted out complete in form, the beekeeper may conclude that if dry it is a case of starvation, and if moist a case of chilled brood. If, however, the contents of the cell adhere to the point of the stick in a ropy ill-smelling mass it may be concluded that the hive is diseased. There is perhaps no surer indication of the presence of foul-brood in the hive than the objectionable smell of the decayed larvæ. Beekeepers who once recognize this odour will have no difficulty in detecting the disease in that stage. The last and most difficult form of foul-brood is the dry stage, and in this form it has baffled beekeepers of long standing. Only a careful examination can reveal its presence. The diseased larva, having dried to a scale, adheres to the lower side of the cell, and can be removed by scraping with a sharp-pointed instrument. If the aforesaid isolated capped cells on being opened appear at the first glance to be empty, they will almost invariably yield a scale if examined, and the hive should be marked for treatment.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of disease which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost fatal to treat the bees in October; in others where right conditions prevail it may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding.

NEGLECTED BEES AND HONEY-PRODUCTION.

As the British Empire has set its mind on the motto, "Food will win the war," it may be wise to follow the lead of our American cousins and, as beekeepers, tackle the question of greater honey-production. To this end beekeepers can assist materially by attending to the apiaries of absent soldiers, and by helping those whose apiaries are not

in a good condition for production. There are many apiaries which only require the skill and advice of the more experienced hands to render them productive, and if these cannot be acquired it rests with the commercial beekeeper to shoulder the responsibility and see that his neighbour employs modern methods. The man who knows can secure a greater return per hive, and his advice should be tactfully given to his less experienced brethren. It is almost out of the question to purchase bees at present, and for beekeepers to increase their stocks by a division of colonies means a certain reduction in the honey-return per hive. However, it is the duty of every experienced man to increase his stock to the limit of the capabilities of his locality.

Says Dr. E. F. Phillips in "A Wasted Sugar-supply," a recent publication of the United States Department of Agriculture, "The beekeeping industry may be the means of conserving a national resource now largely wasted, changing it into nature's own sweet. The raw material is free on every hand; the investment for equipment is small in comparison with other branches of agriculture; the profits are fully commensurate with the study and labour involved. It would seem profitable to stop such a waste of so desirable a supply of sugar. This waste can be prevented only by the education of beekeepers." The production of honey is greater now than at any other period in the history of beekeeping in New Zealand, but we have only touched the fringe of our resources, and what is required is efficiency in working and a general development in the education of beekeepers to promote increased returns.

THE GARDEN.

By W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

FRENCH beans may be sown in all places early in October. The golden-podded butter-beans should be grown where the climate is warm enough, which embraces the greater part of the North Island, these being of better quality than the green-podded varieties. The latter, however, must be grown in the South Island, and are best for the first sowing in the milder parts of the North Island. Canadian Wonder is the best of the green-podded sorts, and Wood's Centenary is the hardiest of the golden-podded varieties—it is, in fact, the best of those generally on the market. The Mont d'Or varieties are prolific and of good quality, but being small are rather tiresome to gather. Sow in broad drills 4 in. deep, setting the beans in two rows 6 in. apart in each row. Mould up as soon as sufficient growth is made; the plants are easily broken off by wind unless supported. Liming for slugs should be attended to; they are unusually troublesome early in the season and have a great liking for the stems of bean-plants. The lime will be good for the beans.

Runner-beans should be planted by the middle of October. To grow these beans well deep and fairly rich soil is required and plenty of moisture. If properly managed, the runner-bean gives a large amount of produce, yielding from January till stopped by frost or a

too-low temperature, and it pays for good treatment. The generally approved plan is to prepare a trench in the same way as for celery, with a good layer of half-rotted stable manure dug into the bottom. The trench is then two-thirds filled with the soil taken out, and the beans planted in two rows 10 in. or 12 in. apart in each row, those in one row being set midway in the intervals between those in the other row. When the plants have grown so as to be just above the top of the trench the sticks are set up and more soil thrown in—sufficient to nearly fill the trench. Leaving a slight depression along the row facilitates watering, plenty of which is wanted during dry weather. There is a statement in circulation to the effect that it is wrong to use stable manure for beans. This assertion has a certain amount of scientific truth behind it, but it is a theory wrongly applied, and it is quite useless to tell an old cultivator with long practical experience that it is bad when he knows it to be the best thing possible. However, when stable manure is not available any kind of decaying green matter, such as weeds, &c., can be used with good effect, but it must be supplemented with artificial fertilizers, such as superphosphate and plenty of lime. It is well understood that stable manure is not indispensable in vegetable-culture, but it is the best manure, and without it a greater use must be made of artificial manures and humus supplied in some form. There are several types of runner-beans, but it will be sufficient to mention those most distinct. One type produces beans like the old scarlet runner, the pods straight with a roughish surface and true green colour. These are the type necessary for exhibition purposes, and the quality is good. Sutton's Best of All and Carter's Scarlet Emperor are of this type. Pods of these can be obtained up to 15 in. long, but to do so the plants must be spaced far apart—about 2 ft. Another type is the climbing sugar-beans. These have practically stringless pods of somewhat uneven shape, not good for exhibition until the standard for judging is altered, but much superior to the others in quality, most prolific, and give long pods without wide spacing of plants. Epicure and Sutton's Climbing Sugar are the best of these. Sutton's climbing french bean is a type by itself; the beans are exactly the same as the best dwarfs, but produced in great abundance. I prefer the climbing sugars to all others.

Unless they have been recently put in, broad beans should be sown. Two sowings are sufficient—June and October. When the plants are about 12 in. high pinch the tops off, or take a pair of hedge-shears and clip them, which is the quickest method. The plants then send out side shoots, thus giving a larger crop and extending the bearing-period, besides preventing injury from wind by keeping them dwarf and stiffening the row.

Sow peas for succession. A medium-tall kind of Dwarf Defiance type is best. Place sticks for support if possible; both crop and quality is improved by keeping the haulm off the ground. A sowing of leeks to provide the main supply should be made at once. It is a loss to plant after the middle of January, and the plants must be a good size before setting them out. Cauliflower should have been sown about the middle of September. If not done delay no longer, as this is an important sowing, producing heads in autumn. A giant kind is recommended; it is this crop that gave rise to the name "Veitch's Autumn Giant." Brussels sprouts should be sown; unless they have a long

season of growth they are of little value. Cabbage, savoys, and broccoli should be sown now, except in places that are extra warm and where true winter weather is late setting in. In such places sow the third week in November, with the exception of early broccoli, which should be sown now. To get the best results broccoli requires a long season of growth; plants put out late give but small heads. Most planting should be finished by the second week in January.

Red beet of a long kind, also carrots and parsnips—all for winter use—may be sown at any time from now till the first week in November, according to local conditions. Sow lettuce thinly in rows, and pull out superfluous plants as soon as possible. Sow radish every ten days in small quantity. Plant red cabbage, also early celery. Sow turnips every seven or eight weeks. When pulling turnips carry them intact off the bed and cut the tops off in one place, so that they can be gathered up and placed in a heap with other refuse. Sprinkle the heap occasionally with lime, and it will make a valuable compost for digging in. Loose leaves lying about a bed encourage slugs.

Tomato-plants should be well hardened in the open air before they are planted out. I have long advocated delaying planting till the first week in November. I have recently learned that one of the largest and most successful growers in the Dominion has found that the best time to plant and is now doing so, and does not sow till the middle of September. Tomatoes under glass should be carefully watered and ventilated, so as to have the house as dry as possible at closing-time. Watering should be done in the morning before the sun gains much power. At this time the temperature of the soil is nearest that of the water, and the lowering of the temperature of the soil by watering is less then than it would be at any other time. There is also the advantage that evaporation takes place while the sun is hot, so that it is immediately dispelled. The surface becomes dry before closing-time, and the house can be closed up without fear of creating a muggy atmosphere, which is highly injurious. Watering should never be done on dull days—wait till a bright day. The plants will not suffer from being a bit dry at root, but they will from a moist atmosphere. The plants should be sprayed with bordeaux, even though they look quite healthy. Diseases are easier prevented than cured.

CLUB-ROOT (PLASMODIOPHORA BRASSICAE) IN THE GARDEN.

This disease, which has caused great losses of cruciferous crops—cabbages, turnips, &c.—is a slime fungus, and in general is caused by acidity of the soil. When diseased roots are examined it is usual to find numerous small white grubs. These have nothing to do with the disease, being merely incidental to the decaying vegetation. Acidity of soil is mainly due to want of lime. The continued use of acid manures will cause acidity even though there may be lime in the soil, as heavy yearly dressings of lime would be required to counteract it. The superphosphate in most general use is acid, bonedust is acid, also sulphate of potash and sulphate of ammonia. Muriate of potash is alkaline. Basic superphosphate is the ordinary kind, to which lime has been added to neutralize the acid. Basic slag is non-acid and is considered a good phosphatic fertilizer for the vegetable-garden. The continued use of stable manure creates an acid state of soil, requiring

liberal dressings of lime to counteract it. Lime is necessary to plant-life. It is a plant-food itself, and, besides, helps most soils by improving the structure of the grains. It sweetens the soil, thereby aiding the little living germs called bacteria, and sets free the potash that is locked up in the soil. It is clear, therefore, that a proper use of lime is a good investment. It must not be expected, however, that applications of lime will quickly cleanse soil that has become infested with the club-root disease; it may take several years to do so. Prevention is the best cure, and that is easy.

It is usually considered necessary to avoid planting cruciferous plants on infested ground, but in the restricted area of most gardens that is difficult. Recent investigations have proved that the disease-germs can live only near the surface of the soil. The exact depth below which they cannot live is not positively determined. Some experimentalists give the maximum depth as 4 in., some double that depth. Whichever may be true, it points to an easy way of dealing with infested garden-soil. All that is necessary is deep trenching, burying the top spit. In the cultivation of cabbages, broccoli, &c., mould-ing-up should be avoided if infection is feared. As, however, some support to the stems is imperative in many cases, it may be advisable to plant deeper. To effect this drills may be drawn with a hoe and the plants set in them, the soil being levelled when the plants have made sufficient growth. The extra depth of planting would be a help in combating the disease. It is obvious that this plan is not available with turnips, also that when they are grown on ridges, as is frequently done, the disease is encouraged by the exposure of a larger surface. If plants of the cabbage tribe are of necessity taken from infested soil the roots should be examined, and any that are not normal should be discarded. The roots of others should before planting be dipped in a puddle composed of mud, soot, and sulphur.

NOTE.—An article by Mr. Taylor on the home-saving of vegetable-seeds is held over until next issue of the *Journal*.—ED.

LEADING PEN OF BLACK ORPINGTONS IN LAST MILTON FEEDING-TEST.

ANSWERS TO CORRESPONDENTS.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COW CHOKING ON TURNIPS.

"NEW CHUM," Lumsden :—

I have a cow that choked with a frosted turnip about a month ago, and since then has choked four or five times a week. Is there any cure for choking; and what would you recommend to remove the obstruction?

The Live-stock Division :—

Once an animal has choked upon turnips there is always a danger of the trouble recurring, as the first choke, by injury to the gullet, makes swallowing more difficult. The usual way to remove an obstruction in the gullet is by the use of the probang, but where this is not available administer a pint of raw linseed-oil, and manipulate the part where the obstruction can be felt, gradually working the turnip up or down.

ROT IN MANGOLDS.

J. G. R., Kihikihi :—

Can you advise me as to the cause of rot amongst mangolds. Part were Long Red and part Jersey Queen. They started to rot in the ground in April, and fully two-thirds have gone bad, the Jersey Queen more so than the other. About half of the Long Red are hollow. The ground is dry, lying on a slope to the sun.

The Fields Division :—

The rot in mangolds so prevalent in the King-country this year is what is known as beet heart-rot, and is caused by a fungus called *Sphaerella tabifica*. This disease has been present in New Zealand for many years past, but rarely has caused sufficient loss to occasion any anxiety. There are no practical methods of control, but in Europe, where the disease is prevalent, liberal dressings of potassic manures seem to keep it in check.

SPRAYING LOGANBERRY AND STRAWBERRY PLANTS.

A. L. FROST, Kaipara Line :—

In the summer the foliage of my loganberry-vines is covered with a kind o red rust, and now the vines are dormant there is a kind of white blight covering the vines. Also my strawberry-plants had on them last season a red rust and small red spots on the leaves. Kindly advise what spray I should use in each case.

The Horticulture Division :—

You should spray the loganberry-plants at once with bordeaux mixture, 4–4–40 strength, or lime-sulphur, 1 in 130. Regarding the strawberry-plants, the leaves should be all cut off and burned in autumn; and in early spring spray with bordeaux, 4–4–40. Of course, these sprays cannot be applied when fruit is on the plants.

RUST-RESISTANT OATS FOR SHEAVES.

"SETTLER," New Lynn :—

What is the best rust-resisting oat to grow for sheaves, and how long does it take to mature?

The Fields Division :—

Either Ruakura oats or heavy-bushel-weight Australian Algerians are the best for this purpose. The time taken to mature depends on a variety of circumstances, but if spring-sown and not grazed it may be put for Algerians at about four months. Ruakura oats are about a fortnight earlier than Algerians sown at the same time. Ruakura oats are probably better for late autumn sowing and feeding off. When spring-sown and not grazed they are apt to lodge, owing to the straw being somewhat soft. It is sometimes difficult to secure Ruakura oats true to name.

DRESSING FOR SEED OATS.

"FRASERTOWN," Hawke's Bay :—

Please inform me in regard to the best dressing for oats as a rust-preventive. How is formalin used ? Please state quantity and mode of procedure.

The Fields Division :—

There is no known dressing which is effective in any measure against rust. Formalin is used as a preventive of smut in oats. One pint of commercial formalin is mixed with 40 gallons of water, and this is sufficient to treat about 40 bushels of seed oats. The solution is sprinkled on the oats, which are turned during the process until the grains are evenly wetted. Leave in the heap for a few hours, then spread out to dry, and sow immediately afterwards.

WALNUT-BLIGHTS.

H. D. REESE, Cambridge :—

Kindly advise what treatment I should give walnut-trees to prevent blight. Mine are just young trees, but have been badly blighted the last two seasons.

The Horticulture Division :—

The walnut is subject to several blights. The most destructive is a bacterial blight which attacks fruit, leaves, and wood. This blight shows on the young nuts in the form of black blotches, which increase in size, sometimes covering the whole nut, which it destroys. No remedy is practicable, as the blight is in the tissues of the plant. Other blights attack the leaves only. In such cases injury is done by loss of leaves, which lowers the vitality of the tree. Spraying is effectual if done while the leaves are young. Bordeaux mixture of 4–4–40 strength should be used. Fallen leaves should be collected and burnt.

SUNFLOWER-SEED FOR POULTRY.

"SUNFLOWER," Wanganui :—

I wish to ask if sunflower-seeds are good for fowls, and, if so, how much to give per bird, and when is the best time to sow them.

The Live-stock Division :—

Sunflower-seed is a first-class poultry-food when fed in conjunction with wheat, oats, maize, &c. It contains a large quantity of oil, which makes it of special value during the moulting-period. The best way of feeding is to throw the heads into the run whole and allow the birds to pick the seeds out themselves. The best time to sow sunflower is about October.

LOTUS ANGUSTISSIMUS.

J. WILLIAMS, Hatuma :—

I notice in the July *Journal* advice regarding *Lotus angustissimus*. Could you tell me how much seed could be threshed per acre, of what value is the seed, and whether an ordinary threshing-mill could thresh it ?

The Fields Division :—

Lotus angustissimus is largely grown on the poorer classes of soils in the North for feed and seed. Yields vary from 1 cwt. to 2 cwt. per acre. The present value of farmers' seed is 1s. 2d. per pound. It can be handled easily with an ordinary mill after stacking for some time.

BLINDNESS IN SHEEP.

JAMES WALKER, Island Block :—

I have some lambs which have gone blind. I fed them on chaff and hay for three days while the snowstorm was on, and a week after they started going blind. Could you advise me in regard to this ?

The Live-stock Division :—

Blindness in sheep may arise from a variety of causes, such as exposure to extreme cold and wet, or indigestion (these being common causes), whilst snow-blindness is common in cold countries. We are inclined to think that the latter was the cause in this case, and the treatment usually adopted consists of enclosing the animals free from the glare of the snow. The trouble usually disappears without medicinal treatment, although in bad cases a cataract on one or both eyes is not uncommon.

PASPALUM FOR HIGH COUNTRY.

A. TOMLINSON, Awapiri :—

I note that good results have been secured with paspalum by surface-sowing. Would you kindly advise whether it would take on this class of country (Upper Awatere), and, if so, is the seed obtainable at a price to permit of surface-sowing ? My country lies from 1,500 ft. to 4,000 ft. above sea-level.

The Fields Division :—

It is probable that paspalum would be winter-killed on your country, but you might certainly try some as an experiment. The seed costs about 1s. 8d. per pound, so that it would have to show very appreciable results to justify its use. We would suggest burning a small area of tussock about the middle of October, and surface-sowing on the ashes about 2 lb. per acre, mixed with 4 lb. danthonia and 6 lb. Yorkshire fog.

CONTROL OF FOXGLOVE.

"SUBSCRIBER," Clevedon :—

We have foxgloves coming on bush country. Are they apt to spread all over same, and smother the grass ? If so, what is the best way to get rid of them ? Does fire affect them ?

The Fields Division :—

Unless attended to foxglove will spread rapidly all over the country, although not to the extent of smothering the grass. Cutting the plants is perhaps the best way of getting rid of them, and this entails a good amount of labour unless done when the plant first appears on the country. In pulling foxglove the work should be completed before the plants are in full flower. The flowering-period is fairly long, and seeds may mature on the lower parts before the upper flowers have finished blossoming. Where eradication is being carried out foxglove should be dealt with at least twice a year; firstly, when the flowering-stems are just beginning to develop the plants should be pulled up; and, secondly, during the blossoming-period any standing should be cut down; at that period also small plants that are not in flower should be pulled. Where the plants are sufficiently thick to carry the fire burning will destroy them.

CRESTED DOGSTAIL AND PASTURE MIXTURE.

"FARMER," Otago :—

Kindly advise in regard to the quantity of crested dogstail to sow down for a permanent pasture by itself, and the quantity you would advise me to include in a mixture for permanent pasture. My country is warm and dry and hard on the northern faces, but good soil on southern faces and basins. I had intended sowing 15 lb. Italian rye-grass, 12 lb. cocksfoot, 8 lb. crested dogstail, and 2 lb. white clover.

The Fields Division :—

Crested dogstail is never sown alone for permanent pasture. There are, however, a good many examples of paddocks sown for seed not being broken up, and remaining in dogstail for many years. Such pastures, however, are unsatisfactory, as many weedy grasses, such as fog, become abundant. When sown pure for seed 18 lb. of dogstail is the amount almost invariably used. We notice that in your suggested mixture you do not include any perennial rye-grass — presumably because you have not found it last any longer than does Italian. If, however, perennial lasts, say, four years or so you should include it in the mixture. In this case we advise a mixture somewhat as follows: Italian rye-grass, 5 lb.; perennial rye, 8 lb.; meadow-fescue, 3 lb.; cocksfoot, 12 lb.; crested dogstail, 6 lb.; red clover, 2 lb.; white clover, 2 lb. If the land is definitely intended for permanent pasture you should entertain (provided the soil is not sour) the sowing of 1 lb. *Poa praiensis*. The question as to whether timothy should be used could only be determined by an exact knowledge of the ground.

LUCERNE ON MOLE-DRAINED LAND.

"RANGITIKEI," Marton :—

Can you tell me whether it is advisable to sow lucerne on drained land? Our land has been drained with drain-plough at a depth of about 20 in.; with outlets of pipe-drain at a depth of about 30 in. The difficulty that presents itself, to my mind, is that the roots of such a deep-rooting plant may block the drains.

The Fields Division :—

For lucerne to be successful its roots must penetrate deeply; and, as a matter of course, they will tend to block the mole channels. Apart from this consideration, it is difficult to establish a good stand of lucerne on land which requires drainage of this kind, and the attempt to do so should be on quite a small scale at first. A heavy dressing of lime (3 tons or more per acre) would help.

GROWING SUDAN AND PRAIRIE GRASS.

"POHARA," Morrinsville :—

I am desirous of sowing Sudan and prairie grass. Will you kindly inform me if these grasses have been in use in New Zealand for sufficient time to be certain they will not take possession like paspalum. What class of soil is suitable for each grass?

The Fields Division :—

Sudan grass has only been grown in New Zealand during the past four seasons. It is an annual, and can be used either as a summer forage-crop or as a seasonal pasture for grazing during the summer and autumn. Sudan grass should be sown in October and November (after all danger of spring frosts is over) in 7 in. drills, using from 15 lb. to 20 lb. of seed, depending on the quality. It gives a good yield of palatable green fodder, or may be made into hay, or grazed three or four times during the summer. The ground should be ploughed in the latter part of April, and would then be available either for winter cereal fodders or for oats—either for chaff or grain. Sudan grass grows well on most soils, but where the fertility is low it requires considerable amounts of phosphatic manures.

Prairie-grass pastures have been sown in New Zealand for many years past, and the great wealth of winter herbage they produce makes them particularly valuable. The chief objection to prairie-grass is the fact that it will not endure continuous stocking, and under such treatment soon becomes eaten out and disappears. Prairie-grass is best sown in February, using about 3 bushels of seed per acre. As the seed cannot be satisfactorily drilled the best method is to broadcast and disk in the seed, harrow and roll, and then sow 20 lb. Italian rye-grass and 5 lb. cow-grass per acre, lightly harrowed in and rolled if necessary. In this way the paddock acts as a temporary pasture until such time as the prairie-grass is well established. Such paddocks should be stocked with cattle, and at no time should be continuously grazed with sheep. Prairie-grass succeeds on a variety of soils, but prefers a well-drained sandy loam.

AGRICULTURAL AND PASTORAL STATISTICS, 1917–18.

INTERIM RETURNS.

THE statistics presented in the following tables were issued by the Government Statistician under date 23rd August, 1918, with the following remarks: Complete returns have so far been received for 119 counties out of the 125 which comprise the Dominion. Estimates have been made for the incomplete portions of the remaining six counties. The tables appended hereto are consequently liable to revision on the complete returns coming to hand, but it is not anticipated that the final results will differ very widely from those quoted below.

PRINCIPAL CROPS.

I.—TABLE SHOWING APPROXIMATE AREAS AND YIELDS OF THE PRINCIPAL CROPS IN EACH LAND DISTRICT IN THE DOMINION FOR THE SEASON 1917–18.

Land District.	Wheat.					Oats.					Barley.			
	For Threshing.		For Chaff, Hay, or Ensilage.		Not harvested (Fed off, &c.).	For Threshing.		For Chaff, Hay, or Ensilage.		Not harvested (Fed off, &c.).	For Threshing.		For Chaff, Hay, or Ensilage.	
	Area.	Yield.	Area.	Yield.		Area.	Yield.	Area.	Yield.		Area.	Yield.	Area.	Yield.
	Acres.	Bushels.	Acres.	Tons.	Acres.	Acres.	Bushels.	Acres.	Tons.	Acres.	Acres.	Bushels.	Acres.	Tons.
Auckland	620	15,476	178	280	95	206	4,448	14,605	19,163	313	333	8,241	125	223
Hawke's Bay	945	24,588	43	82	28	515	15,571	11,051	16,790	360	1,559	65,281	192	398
Taranaki	698	16,986	..	..	..	433	11,491	5,264	9,196	279	273	10,066	36	70
Wellington	6,959	148,182	410	584	68	3,802	107,025	17,506	26,360	596	911	28,024	62	132
Nelson	1,333	20,701	55	68	20	860	17,000	8,641	9,385	196	1,200	23,000	3	20
Marlborough	3,285	57,125	40	51	111	872	22,915	14,607	25,150	532	4,900	118,166	..	..
Westland	..	..	..	..	..	10	300	389	554	130	..	..	3	12
Canterbury	217,272	5,254,374	977	1,975	2,223	79,565	2,066,945	137,439	153,009	15,318	5,777	171,411	65	112
Otago	42,442	1,134,880	345	484	245	36,727	1,280,691	53,417	84,761	2,057	4,062	138,318	59	78
Southland	3,323	88,937	19	25	45	30,409	1,259,005	44,706	68,485	417	274	9,554	1	2
Totals, Dominion, 1917–18 (interim figures only)	276,877	6,761,249	2,067	3,549	2,835	153,399	4,785,391	307,625	412,853	20,198	19,289	572,061	546	1,047
Totals, Dominion, 1916–17 (fina figures)	217,743	5,051,227	3,738	5,186	2,871	177,524	5,371,436	354,550	432,878	32,738	29,646	738,050	1,240	2,151

I.—TABLE SHOWING APPROXIMATE AREAS AND YIELDS OF THE PRINCIPAL CROPS IN EACH LAND DISTRICT IN THE DOMINION FOR THE SEASON 1917–18—*continued.*

Land District.	Maize.				Rye-grass.		Cocksfoot.		Potatoes.		Turnips.	Mangolds.
	For Threshing.		For Ensilage.									
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.		
	Acres.	Bushels.	Acres.	Tons.	Acres.	lb.	Acres.	lb.	Acres.	Tons.	Acres.	Acres.
Auckland	4,852	181,238	336	2,417	309	82,927	880	144,128	2,836	12,134	50,820	1,037
Hawke's Bay	3,093	179,626	83	332	2,529	931,406	289	30,021	1,028	5,115	11,332	200
Taranaki	13	319	33	77	66	16,155	31	5,114	440	1,769	30,834	1,379
Wellington	30	1,029	69	172	3,446	874,057	425	44,269	2,045	10,929	30,877	920
Nelson	..	..	9	85	45	9,990	117	11,571	516	1,780	4,950	17
Marlborough	3	95	7	35	715	132,226	195	21,181	373	1,633	1,942	218
Westland	..	..	..	..	..	..	..	..	36	150	1,685	..
Canterbury	52	1,382	8	25	35,492	12,761,838	13,031	1,924,508	11,529	49,150	103,962	3,616
Otago	..	..	..	..	8,672	1,973,534	1,246	96,718	2,511	8,312	94,163	1,184
Southland	..	..	..	..	17,447	8,733,604	386	106,477	1,321	6,972	110,720	40
Totals, Dominion, 1917-18 (interim figures only)	8,043	363,689	545	3,143	68,721	25,515,737	16,600	2,383,987	22,635	97,944	441,295	8,611
Totals, Dominion, 1916-17 (final figures)	6,359	274,283	711	5,107	79,135	23,049,749	16,134	1,907,043	26,156	133,642	526,283	9,073

[*Average Yields.*—On the above figures average Dominion yields per acre for the 1917–18 season work out as follows : Wheat, 24·42 bushels; oats, 31·13 bushels; barley, 29·65 bushels; maize, 45·22 bushels; rye-grass, 371·28 lb.; cocksfoot, 143·68 lb.; potatoes, 4·32 tons.]

AGRICULTURAL AND PASTORAL STATISTICS, 1917–18—*continued.*

LIVE-STOCK.

II.—TABLE SHOWING THE APPROXIMATE NUMBERS OF THE PRINCIPAL VARIETIES OF LIVE-STOCK IN EACH LAND DISTRICT IN THE DOMINION (INCLUSIVE OF ITS INTERIOR BOROUGHS).

Land District.	Horses, as at 31st Jan., 1918.	Dairy Cows, as at 31st Jan., 1918 (in Milk and Dry).	Total Cattle, as at 31st Jan., 1918 (including Figures in Previous Column).	Number of Sheep shorn, Season 1917–18.	Number of Lambs tailed, Season 1917–18.	Sheep (including Lambs), as at 30th April, 1918.	Pigs, as at 31st Jan., 1918.
Auckland	98,740	284,937	974,345	1,829,680	807,932	1,844,666	80,239
Hawke's Bay	39,754	43,115	428,607	5,726,715	2,559,184	6,308,338	16,129
Taranaki	25,716	147,523	353,941	1,039,764	375,455	960,219	37,609
Wellington	52,584	130,749	551,646	5,248,085	2,611,678	5,724,165	36,768
Nelson	9,014	18,717	54,586	414,282	178,768	473,270	9,827
Marlborough	7,523	10,882	35,991	965,592	414,262	1,037,660	6,821
Westland	3,461	10,024	38,569	64,679	27,883	66,907	3,494
Canterbury	68,964	59,775	175,798	4,058,374	2,300,013	5,135,942	41,695
Otago	42,338	45,694	126,021	2,641,953	1,179,824	3,097,291	14,260
Southland	30,897	46,153	148,710	1,562,450	788,803	1,889,844	11,427
Totals, Dominion, 1918 (interim figures only)	378,991	797,569	2,888,214	23,651,574	11,243,802	26,538,302*	258,269
Totals, Dominion, 1917 (final figures) ..	373,600	777,439	2,575,230	22,462,291	10,745,386	25,270,386	283,770

* Final.

IMPORTATION OF FERTILIZERS: QUARTER ENDED 30TH JUNE, 1918.

Kind.	Country of Departure.	Auckland.		Wellington.		New Plymouth.		Napier.		Lyttelton.		Timaru.		Dunedin.		Invercargill.		Totals.	
		Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£
Sulphate of ammonia ..	Australia ..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Blood manure	Australia ..	15	222	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	222
Cyanamide, nitrolim, &c...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gypsum	Australia ..	..	..	295	690	..	..	..	..	..	4	..	..	..	..	..	..	295	694
Nitrate of lime	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nitrate of soda.. ..	Chile	50	816	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50	816
Basic slag and Thomas phosphate	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"Basic phosphate" ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blood-and-bone ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bonedust	Australia ..	213	1,997	..	..	..	..	..	..	..	..	..	..	..	..	..	..	213	1,997
	India	1,350	8,723	50	385	..	..	..	..	..	..	..	..	..	..	..	..	1,400	9,108
	Total ..	1,563	10,720	50	385	..	..	..	..	..	..	..	..	..	..	..	..	1,613	11,105
Chardust or bone char ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Guano and rock phosphate	India	1	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	3
	Australia ..	27	135	375	1,106	..	..	..	..	..	..	..	..	..	..	268	811	670	2,052
	Makatea Island	570	941	..	..	..	..	..	..	..	..	..	..	..	..	..	..	570	941
	Total ..	598	1,079	375	1,106	..	..	..	..	..	..	..	..	..	..	268	811	1,241	2,996
Superphosphate ..	Australia ..	800	4,374	1,676	8,659	145	698	..	..	510	2,835	1,650	8,394	620	3,372	1,829	9,194	7,230	37,526
Kainit, muriate of potash, sulphate of potash, and other potash manures	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sulphate of iron ..	United Kingdom	..	..	..	..	..	..	..	..	3	7	..	..	..	2	..	..	3	9
Other manures .. .	United Kingdom	1	14	..	15	..	..	..	..	..	1	..	..	..	..	..	..	1	30
	Australia ..	1	11	..	2	..	..	..	..	..	..	..	..	..	..	120	383	121	396
	Total ..	2	25	..	17	..	..	..	..	..	1	..	..	..	..	120	383	122	426

NOTE.—With regard to the "declared values" which are given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent does not nearly cover the present freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

IMPORTATION OF FRESH FRUIT, 1917–18.

THE following table shows the varieties and quantities of fresh fruits imported into New Zealand at the different ports of inspection during the year ended 31st March, 1918. The figures represent cases.

Port of Inspection.	Apples.	Pears.	Loquats.	Grapes.	Plums.	Cherries.
Auckland ..	53,942	..	118	..	32	1,351
Wellington ..	5,194	..	90	..	..	2,228
Lyttelton ..	3,797	..	..	..	..	50
Dunedin ..	5,455	3	..	..	..	..
Bluff ..	1,273	..	..	..	..	..
Totals ..	69,661	3	208	..	32	3,629

Port of Inspection.	Oranges.	Mandarins.	Lemons.	Pines.	Passions.	Bananas.
Auckland ..	80,689	3,152	859	8,121	486	287,785
Wellington ..	34,963	10,972	5,565	4,992	2,030	20,735
Lyttelton ..	12,920	2,585	1,571	1,280	617	9,886
Dunedin ..	6,881	1,681	1,396	1,082	215	2,177
Bluff ..	2,414	492	364	326	182	184
Totals ..	137,867	18,882	9,755	15,801	3,530	320,767

The totals of all varieties imported at the several ports are as follows: Auckland, 436,535; Wellington, 86,769; Lyttelton, 32,706; Dunedin, 18,890; and Bluff, 5,235 cases. The grand total for the Dominion is 580,135 cases, as against 637,957 cases in the previous twelve months.

The Department's Bull Sale.—Among the young Friesians to be sold at Weraroa, on 2nd October, may be specially noticed Primrose Olga, a two-year-old of pure Longbeach parentage, whose dam's average of 545 lb. butter-fat for her first four milking-periods was made under commercial dairying-conditions. His sire, Primrose League, is by Longbeach King Domino, by Kruger II, from the famous cow Domino III, whose best day's milking was 113¼ lb. Another exceptionally well-bred yearling of Longbeach blood and type is Domino Dutch Lad, son of Domino's Pride (female champion at the Manawatu Show, 1917), combining as he does a double strain of Domino III, with relationship to Kruger II and Van Tromp.

Prominent among the Shorthorns offered is Dominion Goldfinder, a fine type of young Milking Shorthorn bull. His sire, Banker II, is by Charge of Darbalara from Daphne V (437 lb. butter-fat). His dam, Bertha IV, produced 382 lb. butter-fat in the 1916–17 season, and 370 lb. in the first 300 days of her current period of lactation. Goldfinder thus possesses some of the best Darbalara blood, with solid utility records on the female side.

Annual Sheep Returns.—The complete returns show a Dominion total of 26,538,302 head, being an increase of 183,708 on the figures of the interim return. Tables giving details will be recorded in next month's *Journal*.

Registration of Orchards.—Fruitgrowers are reminded that all orchards from which fruit is sold or which have been planted for the production of fruit for sale, although not yet in bearing, are to be registered during the month of September of each year. Registration is free of charge. The penalty for non-registration is a fine not exceeding £20. Registration forms are available on application to any Orchard Instructor or District Agent's Office, or the Horticulture Division of the Department, Wellington.

Settings of Eggs from utility-poultry stock are obtainable up to 30th November from the Department's stations at Ruakura and Milton, according to details announced in the June and July issues of the *Journal*.

WERAROA SALE OF PEDIGREE DAIRY BULLS.

THE Department's annual draft sale of yearling pedigree dairy bulls from tested dams will be held at the Central Development Farm, Weraroa, Levin, on 2nd October, commencing at 12 noon.

The stock to be offered consists of fifteen Friesians, eight Milking Shorthorns, and one Guernsey. The Friesians comprise several bulls of pure Longbeach strain, sons of Dominion Olga, Dominion Domino's Pride, Dominion Freda, &c., by Primrose League, a grandson of the famous old cow Domino III. Included in the youngsters to be offered are also several of pure American blood, from cows imported from the famous Woodcrest stud, and by the noted imported dairy sires Woodcrest Joe and Oak de Kol II Homestead Fobes.

The majority of the Milking Shorthorns are of pure Darbalara blood, and are by sires imported from that famous New South Wales herd, several also being out of pure Darbalara cows.

Following is a list of the animals to be offered, together with some of the dams' milking-records, &c., full particulars being given in the catalogue :—

Friesians.

DOMINION PRIMROSE OLGA (two years) : Primrose League—Olga. Butter-fat : 1914–15, 609·78 lb. ; 1915–16, 611·24 lb. ; 1916–17, 485·25 lb. ; 1917–18, 477·72 lb. Average of four years, 545·60 lb.

DOMINION DOMINO DUTCH LAD : Primrose League—Domino's Pride. Milk, 12,688·50 lb. ; butter-fat, 472·75 lb.

DOMINION FRIESIAN LEAGUE : Primrose League—Freda. Milk, 13,048 lb. ; butter-fat, 428·91 lb.

DOMINION SIR AGNES : Oak de Kol II Homestead Fobes—Woodcrest Aaggie Grace. Milk, 11,129 lb. ; butter-fat, 381·87 lb.

DOMINION OAKWOOD : Oak de Kol II Homestead Fobes—Woodcrest Daisy. Milk, 13,306 lb. ; butter-fat, 423·82 lb.

DOMINION FAYNE DE KOL : Oak de Kol II Homestead Fobes—Dominion Fayne. Butter-fat, 221·59 lb., 186 days (still milking).

DOMINION WOODCREST : Woodcrest Joe—Aaggie Grace Korndyke.

DOMINION DUTCH OAK : Primrose League—Florence. Milk, 9,621·75 lb. ; butter-fat, 314·54 lb.

DOMINION ACORN : Primrose League—Lady Tritomia. Milk, 13,346·75 lb. ; butter-fat, 408·24 lb. (357 days).

DOMINION ROMANOFF : Primrose League—Roma. Milk, 11,904·25 lb. ; butter-fat, 385·89 lb.

DOMINION WOODCREST JULIA : Woodcrest Joe—Julia de Kol. Milk, 8,983 lb. ; butter-fat, 395·08 lb.

DOMINION OAKDALE : Oak de Kol II Homestead Fobes—Ranee. Did not milk full season owing to accident ; first daughter, 414 lb. butter-fat on first calf.

DOMINION DE KOL OAK : Oak de Kol II Homestead Fobes—Annette.

DOMINION TROMP DE KOL : Tromp—Aaggie Fobes. Milk, 10,111·25 lb. ; butter-fat, 334 lb. (as two-year heifer).

DOMINION FAYNE TROMP : Tromp—Ida Segis (milking on first calf).

Shorthorns.

DOMINION GOLDFINDER : Banker II—Bertha IV. Butter-fat, 370 lb., 300 days (still milking).

DOMINION RUTHGLEN : Banker II — Ruth. Milk, 7,833 lb. ; butter-fat, 268·01 lb.

DOMINION DUKE : Banker II—Nora. Milk, 7,829 lb. ; butter-fat, 306·2 lb.

DOMINION BANNERMORE : Banker II—Lilly. Milk, 6,381 lb. ; butter-fat, 222·7 lb.

DOMINION LUCIFER'S PRIDE : Lucifer of Darbalara—Bertha V. Butter-fat, 207·87 lb., 236 days (first calf, and was severely injured in middle of season).

DOMINION PROUD DARBALARA : Lucifer of Darbalara—Daphne VI.

DOMINION JACOB : Banker II—Lady Rachel. Butter-fat, 269·7 lb. at two years.

DOMINION THE DAUPHIN : Lucifer of Darbalara — Madam. Butter-fat, 226·11 lb. at two years.

Guernsey.

DOMINION DOUGLAS HAIG : General French—Leonie III of Wollongbar.